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The following publications of the Bureau are available at the prices indicated:

	s.	d.
Wheat Breeding Bibliography, Part I ...	1	6
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Bibliography on Interspecific and Intergeneric Hybridization in Relation to Plant-Breeding	2	0
Account of the Research in Progress in the British Empire	3	6
Subject Index to Vols. I and II of "Plant Breeding Abstracts"	2	6

Plant Breeding Abstracts.

Vol. III, No. 2.

Part I. British Empire

GENETICS 575

132. HOGBEN, L. 575.114:519.24
The genetic analysis of familial traits. I. Single gene substitutions.
J. Genet. 1931 : **25** : 97–112.
The genetic analysis of familial traits. II. Double gene substitutions, with special reference to hereditary dwarfism.
J. Genet. 1932 : **25** : 211–40.
The factorial analysis of small families with parents of undetermined genotype.
J. Genet. 1932 : **26** : 75–79.
HALDANE, J. B. S.
A method for investigating recessive characters in man.
J. Genet. 1932 : **25** : 251–56.

An important series of papers, which although concerned with human families, may quite well be shewn in the future to be applicable to other genetic data. Statistical methods are developed for the determination of the probability that the offspring of two heterozygous parents should be recessive, and the significance of the deviation in actual data from hypothesis is measured by the calculation of a standard error. In Hogben's first two papers this latter involved the unknown probability, but Haldane showed how the problem could be solved by the method of maximum likelihood. In his third paper Hogben derives the standard error of the expected number of recessives. The solution is seen to be equivalent to that given previously by the same author, and to be free from an *a priori* assumption implicit in the earlier statement.

133. HOGBEN, L. 575.116.7
Filial and fraternal correlations in sex-linked inheritance.
Proc. Roy. Soc. Edin. 1932 : **52** : 331–36.

The ancestral and fraternal correlations arising from the principle of segregation are discussed, the purpose of this communication being to direct attention to the type of correlation arising when the variance is due to X-borne genes. A number of simple cases are considered, and conclusions reached which are held to throw light on the extent to which sex-linked inheritance contributes to the observed variance for a given measurable character in a mixed population.

134. VAVILOV, N. I. 576.16
The problem of the origin of the world's agriculture in the light of the latest investigations.
Science at the Cross Roads, published by Kniga, London 1931 : Pp. 10.

Seven primary centres of the origin of cultivated plants are distinguished and it is thought that these can be identified with seven corresponding foci of independent development of world agriculture.

The characteristics of these centres are given in turn, indicating the grounds for considering them autonomous.

It is further shewn how the wealth of the world species is largely concentrated in relatively restricted areas, mostly lying within the mountainous tropics and subtropics.

135. DARLINGTON, C. D. 576.354.4:575.113
The control of the chromosomes by the genotype and its bearing on some evolutionary problems.
Amer. Nat. 1932 : **66** : 25–51.
A distinction is drawn between genetic and structural causes of differences in chromosome form and behaviour and examples are given of cases where such differences appear to be genotypically determined. The relation of chromosome variation to such problems as the origin of meiosis, sexual dimorphism and parthenogenesis, is briefly indicated.

AGRICULTURE 631

136. FORSTER, H. C. and VASEY, A. J. 631.421:519.24
The development of accuracy in agricultural experiments.
J. Dept. Agric., Vict. 1932 : **30** : 35–52.
This is an account of certain types of field experimentation, and of the advances that have been made from time to time in field technique. The methods are applied to cereal trials in Victoria. A statistical appendix is incorporated, and there is a useful bibliography of the literature of the subject.

137. BESCOBY, H. B. 631.421:519.24:633.16
The technique of a barley manuring trial.
J. S.-E. Agric. Coll., Wye, 1932 : **30** : 215–30.
A very readable and useful description of the method of statistical analysis for a complex agricultural experiment, involving the calculation of interactions of several treatments.

138. GREGORY, F. G., CROWTHER, F. and LAMBERT, A. R. 631.421:519.24:633.51
The inter-relations of factors controlling the production of cotton under irrigation in the Sudan.
J. Agric. Sci. 1932 : **22** : 617–38.
This is a description of two seasons' experimental work with cotton. The lay-out is elaborate, comprising no fewer than 288 plots, and the factors tested were : four sowing dates, three spacings, three water duties and the application of nitrogenous fertiliser. A description is given of a statistical analysis of the results by the method of analysis of variance. The effects of all single factors were found to be highly significant, and in addition many of the interactions showed up significantly. These are discussed in the paper, and it is shown how various combinations of the factors may be utilized to give the maximum yield. The results of the two years, although the mean yields were very different, corroborated each other closely.

139. KALAMKAR, R. J. 631.421:633.1
A study in sampling technique with wheat.
J. Agric. Sci. 1932 : **22** : 783–96.
Following on Clapham's work on the technique of sampling field crops, the author harvested an entire plot of wheat, 1/40 acre in size, in half-metre lengths. The data thus obtained enabled valuable information to be deduced on the variation in yield within the rows, and from row to row throughout the plot. In particular the best structure for a sampling unit was determined experimentally by trial of several methods. Since the variation between rows was much greater than that within rows, the best unit was one consisting of a number of short lengths from adjacent rows. The author demonstrated edge effect and competition between rows, and obtained a significant correlation between yield and ear number.

140. SCOTT, R. A. 631.421:633.491
Potato manurial trials, 1930-32.
Tasmanian J. Agric. 1932 : **3** : p. 136. Also Supplement, pp. 16.
A description is given of a number of trials carried out on potatoes according to the modern methods, and particularly interesting because of the adoption of a new form of lay-out, here called the semi-latin square, which has much of the advantage of the latin square and yet retains

the flexibility of the method of randomized blocks. It is, therefore, likely to be useful where a considerable number of varieties or treatments is to be tested, but only limited replication can be allowed for. The method has also been advocated by " Student " under the name " equalized random blocks."

141. KOTTUR, G. L. 631.524.4:575
The value of local varieties in plant breeding and the danger of losing them.
Poona Agric. Coll. Mag. 1932 : **24** : 19–25.
The local varieties are the result of years of selection and possess many valuable properties of great importance to the breeder for which purpose they should be preserved.

ECONOMIC PLANTS 633

142. JARRETT, P. H. 633.11–2.451.3 *Urocystis*–1.521.6
Investigations on flag smut of wheat.
J. Counc. Sci. Ind. Res. Vict. 1932 : **5** : 165–69.
A brief account of the fungus. No variety is immune but a group of resistant varieties was found.

633.11–2.451.3–1.521.6:575.11
143. CHURCHWARD, J. G. 633.11:575.11
Inheritance of resistance to bunt, *Tilletia tritici* (Bjerk.) Winter, and other characters in certain crosses of " Florence " wheat.
Proc. Linn. Soc. N.S.W. 1932 : **57** : 133–47.
Florence is one of the most resistant of the Australian wheats. It was crossed with 4 others, all of which were susceptible. F_2 results are presented from which it is concluded that susceptibility is dominant and depends on a single factor, the F_3 results being also in agreement with this conclusion.
The results of the crosses individually are described briefly and shewn to conform to this general interpretation.
Dwarf plants, the so-called " grass clumps," appeared in the F_2 of 5 of the crosses, their proportions agreeing statistically with the expectation on the assumption of the 13 : 3 ratio for inhibiting factors. In the cross Florence x Yandilla King the proportions of 313 normals : 44 dwarfs were observed however, which are interpreted on the basis of 1 dominant inhibitor plus 2 dominant dwarf factors. This interpretation was again confirmed in the F_3.
There was no apparent correlation between bunt resistance and chaff colour, whose inheritance was interpreted on a single factor basis.

144. WATERHOUSE, W. L. 633.11–2.452 *P. triticina*:576.16:575.12
On the production in Australia of two new physiologic forms of leaf rust of wheat, *Puccinia triticina*.
Proc. Linn. Soc. N.S.W. 1932 : **57** : 92–94.
From inoculations of *P. triticina* containing both the Australian forms, 1 and 2, aecia containing 4 forms resulted, forms 1 and 2 being recovered, the remaining 2 being new to Australia. It is probable that the new forms have arisen by hybridization.

145. WENHOLZ, H. and MACINDOE, S. L. 633.11:664.641.016:575(94)
The need for improvement in the baking quality of Australian wheat.
Agric. Gaz. N.S.W. 1932 : **43** : 717–25.
Until recently, the popular high-yielding Australian wheats have been poor in baking quality but increased export trade has necessitated an attempt to improve the quality.
Low quality wheats are being grown in districts where the climatic conditions have an adverse effect on the quality of many varieties but the combination of high yield and improved quality is being aimed at where conditions are favourable.

146. ROBB, W. 633.13:575.113.42.061.6:581.48
Notes on the inheritance of grain colour in certain oat hybrids.
J. Genet. 1932 : **26** : 231–38.

The F_2's of 25 crosses between black and white-grained oat varieties were classified on the basis of grain colour into the three classes, black, grey and white. Six hybrids segregated according to a 3 : 1 ratio (black : white), 3 hybrids according to a 12 : 3 : 1 ratio, and 16 hybrids according to a 60 : 3 : 1 ratio. In the last class there was an almost continuous series of grain colour types ranging from black to just a trace of grey on the inner palea, and it is believed that the action of the factors is cumulative, similar to that noted in certain wheat crosses by Nilsson-Ehle.

There is apparently a qualitative though not a numerical difference in the factors responsible for grain colour in the varieties Myrtle and Black Mesdag.

147. HUSKINS, C. L. and JONES, E. T. 633.13:575.242
Fatuoids or false wild oats.
Nature 1932 : **130** : 132–33.

Professor Huskins points out that the mutation simultaneously of several genes is highly improbable and regards the occurrence of fatuoids referred to by Jones (" Plant Breeding Abstracts " Vol. II, Abst. 532) as supporting the theory of linked genes.

The absence of crossing over is a general characteristic of the non-homologous regions of aberrant chromosomes. Recent work has shewn that certain mutant parts of chromosomes, as opposed to whole chromosomes, are duplicated.

Mr. Jones points out that the cross-over types he referred to were F_3 segregates having the diploid chromosome number. Also that mutations have occurred in the C chromosome shewing different degrees of complexity—fatuoids, sub-fatuoids, semi-fatuoids, and merely strongly awned types, indicating that the genes mutate independently.

The validity of the chromosome aberration hypothesis is not questioned but it is maintained that it is inapplicable to the A series shewing normal segregation and chromosome number.

633.15:575.125
148. ASHBY, E. 581.1:575.11
Studies in the inheritance of physiological characters. II. Further experiments upon the basis of hybrid vigour and upon the inheritance of efficiency index and respiration rate in maize.
Ann. Bot. Oxford 1932 : **96** : 1007–32.

Hybrid vigour is thought to be due simply to a larger initial embryo size in the hybrid. Dry weight determinations, at intervals, of two inbred lines and their F_1 hybrid indicated that the two parents differed in their efficiency indices while the rate of increase in the F_1 was similar to that in the higher parent. The author claims that the greater efficiency index is inherited as a completely dominant character and attempts to demonstrate mathematically that segregation for efficiency index takes place in the F_2.

The embryo weights in the two reciprocals of the cross studied differed, the heavier embryo being found in the more vigorous reciprocal. Embryos dissected out of the grains at an early stage and grown in darkness on filter paper moistened with distilled water exhibited hybrid vigour, indicating that the endosperm was not an essential factor for the manifestation of this phenomenon.

The rate of respiration differed in the parents and that of the hybrid was very similar to that of one of the parents.

149. RANGASWAMI AYYANGAR, G. N., KRISHNA RAO, P. 633.17:575.11.061.1:581.46
and ACHYUTHA WARIAR, U.
The inheritance of characters in Ragi, *Eleusine coracana* (Gaertn.), Part VI. Earhead shapes.
Ind. J. Agric. Sci. 1932 : **2** : 254–65.

The panicle shape of *Eleusine coracana* can be divided into two groups according as the spikes curve inwards or open outwards. These groups can be further divided, the first into top-curved in which only the tips of the spikes curve in, and in-curved with shorter spikes that curve inwards to a greater extent ; and the second into long opens and short opens.

Two factors determine the head shape, Q a factor for density is present in the curveds but absent in the opens and the presence of E, a factor for length, distinguishes the long opens from the short opens in which it is absent, and the in-curveds in which it is absent from the top-curveds.
These factors are independent of the factors for purple pigmentation.

150. RANGASWAMI AYYANGAR, G. N. and SANKARA AYYAR, M.A. 633.174:575.11.061.6
Inheritance of characters in sorghum, I. Chlorophyll deficiencies.
Ind. J. Agric. Sci. 1932 : **2** : 266–70.
Five types of chlorophyll deficiencies are described, pure albino, virescent white, lethal pale green, lingering lethal pale green and surviving pale green ; all behaved as simple recessives to normal green.
The shortage of recessives of the lingering pale green class is attributed to the presence of a zygotic lethal factor.

151. KULKARNI, R. K. 633.174:575.42:631.557
Type and variability in Maldandi jowar (*Andropogon sorghum*).
Poona Agric. Coll. Mag. 1932 : **24** : 51–54.
A considerable amount of variation was found in this variety of jowar. Selection was undertaken to discover the variability of plant height, length and breadth of ear head and grain size and the connection of these characters with yield.
Height of plants was found to be moderately correlated with yield, length and breadth of the ear head highly so, while there was a negative correlation between yield and number of grains per gram. Low yielding types may therefore be eliminated by sieving the grain.

152. 633.18:575"793"(94)
Are we producing the right type of rice ?
Agric. Gaz. N.S.W. 1932 : **43** : p. 761.
The soft-grained types are grown because none of the higher quality hard types are sufficiently early in maturity. Breeding experiments are in progress to combine these two properties.

153. MITRA, S. K. and GANGULI, P. M. 633.18:575.11:575.127.2
Some observations on the characters of wild rice hybrids.
Ind. J. Agric. Sci. 1932 : **2** : 271–79.
Crosses were made between the wild rice *O. sativa* var. *fatua* and a variety of cultivated rice. The former was used as the pollen parent. The F_1 resembled the wild parent but shewed marked hybrid vigour.
The colour of the leaf-sheath, pulvinus, ligule, leaf margin, internode, apiculus and stigma shewed a monofactorial inheritance as did also the colour of the node and the spreading habit of growth. The results indicated two complementary factors for the following characters : colour of auricle, colour of outer and inner glume (floral), colour of inner glume (mature), colour of kernel, panicle habit and length of awn.

633.42:581.162.5
154. AKHTAR, A. R. 633.853.49:581.162.5
Studies in Indian *Brassicae*, I. Sterility and selective pollen tube growth.
Ind. J. Agric. Sci. 1932 : **2** : 280–92.
Some species are self-sterile, others self-fertile. Plants of *Eruca sativa* were observed in which the female reproductive organs were defective, but in general there was no obvious cause of sterility.
Experiments with black *sarson* late, *Brassica campestris* L. var. *oleifera* Prain shewed that most seed was set when pollen from different flowers on the same plant was used on flowers 1–2 days before they opened. Larger pods were formed when the flowers were cross-pollinated.
Investigations on the rate of pollen tube growth shewed that the pollen germinated in all cases, that the growth of the foreign pollen was the most rapid (5 hours), that pollen from other flowers of the same plant took 24 hours, so that if it was applied 1–2 days before the flower opened fertilization was accomplished.

155. HARLAND, S. C. 633.51(72 + 72.81 + 86)
(The cottons of Mexico, Guatemala and Colombia.)
Emp. Cott. Grow. Rev. 1932 : **9** : 337–39.
A review of the cotton section of the monograph by Bukasov* (see " Plant Breeding Abstracts " Vol. II, Abst. 570) in which one or two original remarks on the part of the reviewer are made, chiefly respecting the genic composition and systematic position of the Central American group.

156. HARLAND, S. C. 633.51:575.42:631.525:575.2
The acclimatization of cottons in new areas.
Emp. Cott. Grow. Rev. 1932 : **9** : 285–90.
Reference is made to the difference between the wild and cultivated cottons, in respect of those characters which make for yield and quality of lint, all of which differences are the result of selection in the past. Hence in introduction, the background against which the type under consideration was selected, must be borne in mind. Repeated selection in a given district leads to the gradual discarding of all genes but those which make for success in that district and the very genes discarded are often those which would make for success in a different district. Interesting examples are given of cases in which all introductions of modern highly-bred cottons of a particular type have failed, whereas more primitive cottons of this type have succeeded.
The necessary variation in genes can be obtained by using a wild type or its hybrids for selection. The method recommended is to make a large mixed F_4 population by selfing a large number of the best F_2 and F_3 plants or repeating this process even further. A similar method is advocated also when crossing two well-adapted cottons possessing characters which it is desired to combine. Here the method of backcrossing to one of the parents is often preferable to selfing.
Suitable wild parents for different purposes are suggested.

157. KOTTUR, G. L. 633.51–2.484–1.521.6:575
Breeding for disease resistance at Dharwar.
Curr. Sci. Mysore 1932 : **1** : p. 78.
By selecting the few plants of Kumpta cotton which remained after a heavy attack of *Fusarium*, Dharwar 2 was evolved. Although 90—98 per cent resistant it was wanting in respect to staple and other characters and was therefore crossed with Dharwar 1. From this a resistant type desirable in every way has been produced and is now under extensive cultivation.

158. BROWN, C. H., SELIM, ABD EL GHAFFAR and YOUSSEF, A. 633.51:677.21:575(62)
A preliminary note on the physiological and genetic aspects of hair properties in Egyptian cottons.
Bull. Tech. Sci. Serv. Cairo 1932 : **123** : pp. 19.
Measurements of mercerized diameter, cross-section and wall thickness of collapsed hair, uncollapsed diameter, hair weight per centimetre and intrinsic strength, were made on comparative samples from chequer plots of several varieties of cotton.
The results shew that selection has effected an improvement in the properties of the hair and that further improvement is possible.

159. BANERJI, I. 633.523:581.162.4
The development of the embryo-sac and fertilization in jute.
J. Ind. Bot. Soc. 1932 : **11** : 228–40.
The development of the embryo-sac which was studied in detail is of the normal type ; fertilization and the early stages of the embryo were also studied.

633.528.2:576.312.35
160. ASANA, J. J. and SUTARIA, R. N. 635.62:576.312.35
Microsporo-genesis in *Luffa aegyptiaca* Mill.
J. Ind. Bot. Soc. 1932 : **11** : 181–87.
The chromosome number for *Luffa aegyptiaca* is n = 13. A list of the chromosome numbers known in the *Cucurbitaceae* is given.

* A full translation of the section under review is on file at the Bureau.

161. CHEESMAN, E. E. 633.74:575
The economic botany of cacao. A critical survey of the literature to the end of 1930.
Trop. Agriculture 1932 : (Suppl.) **9** : pp. 16.
The systematic relationships of the genus *Theobroma* are discussed and the inter-relationships of *T. Cacao*.
The life history and morphology of the plant are described and the economic problems are then discussed.
These are grouped under yield and quality and are treated from the genetical, physiological and pathological aspects.
A bibliography of 75 titles is appended.

162. HALL, D. 634.1/8:575
Breeding of fruit.
Bull. Univ. Coll. Reading 1931 : **41** : 113–18.
After indicating the extreme complexity of the problem of improvement by hybridization in the majority of fruit trees, the author gives a popular explanation of polyploidy, shewing its significance in our common fruit trees and their improvement.
The role of cultivation in revealing mutant genes already present is emphasized. It is admitted that mutations arise under cultivation, but not that they arise more frequently than in the wild state. Judgment is reserved as to the value to future breeding of induced mutations.

634.1/8:581.162.5:575.11
163. CRANE, M. B. 634.1/8:581.162.5:576.356
Fertility in relation to yield in cultivated fruits.
Bull. Univ. Coll. Reading 1931 : **41** : 119–29.
A brief analysis is given of the inheritance of incompatibility, by which it is illustrated that the greater complication in the plums than in the cherries is connected with the polyploid nature of the plums. Moreover, when the still more complex polyploidy of the apples is taken into consideration it is seen that the degree of incompatibility diminishes with increased polyploidy. In other groups the chromosome constitution is directly responsible for the sterility and chromosome doubling is pointed out as a potent agent in overcoming this and in originating new forms. The peculiar state of secondary polyploidy associated with the pome fruits is briefly explained.

164. SPINKS, G. T. 634.1/7:575(42)
Fruit breeding.
Bull. Univ. Coll. Reading 1931 : **41** : 140–43.
A general outline is given of the breeding work in progress at the Long Ashton Research Station. The main aims in addition to vigour and yield are the extension of the cropping season, the production of forms resistant to various diseases and pests and of types suitable for preservation. A summary of the main crosses made in apples, pears, plums, black currants, raspberries and other *Rubus*, and strawberries, with indications of the object and results of each, is presented.

165. MOFFETT, A. A. 634.22:576.312.35
Note on the cytology of *Prunus* rootstocks.
J. Pom. Hort. Sci. 1932 : **10** : 181–83.
The chromosome numbers of a number of varieties of *Prunus* used as rootstocks were investigated and their probable origin is discussed in the light of the results.

634.771:575
166. **Banana breeding, etc.**
J. Jamaica Agric. Soc. 1932 : **36** : 463–65.
Efforts are being made to find a banana with the qualities of the Gros Michel that is resistant to the Panama disease and to hurricanes.
Crosses between Gros Michel and Robusta had produced seedlings immune, up to the present, to the disease. A dwarf variant of Gros Michel had been discovered.

Part II. Foreign.

GENETICS 575

167. C'. . . . . ., R. C. 575(063)
The Genetics Congress.
J. Hered. 1932 : **23** : 355–60.
A very brief general account.

168. Roodenburg, J. W. M. 575:578.082
Electrisch licht als hulpmiddel bij het kweeken van planten in den winter.
(Electric light as a means to growing plants in the winter.)
Landbouwk. T. 1932 : **44** : 493–501.
A condensed account of the work referred to in " Plant Breeding Abstracts " Vol. I, Abst. No. 135.

169. Morgan, T. H. 575.1
The rise of genetics.
Science 1932 : **76** : 261–67.
A masterly survey of the history of the science of cytogenetics from pre-Mendelian times.

170. MacArthur, J. W. 575.114:519.24
The distribution of genes among isometric chromosomes.
Amer. Nat. 1932 : **66** : 560–65.
It is suggested that in species where the chromosomes are very uniform in size some help in making a genetical analysis may be afforded by adaptations of the binomial formula $\frac{(n-1}{n} + \frac{1)m}{n}$.

171. 575.116.1
633.15:575.116.1
Eloff, G. 635.656:575.116.1
A theoretical and experimental study on the changes in the crossing-over value, their causes and meaning.
Genetica. 1932 : **14** : 3–116.
A very detailed study of changes in the crossing-over value brought about by temperature, X-rays, radium, age, sex, crossover modifiers, etc. Most of the examples are from the animal kingdom and only the sections relating to *Zea* and *Pisum* are summarized below.
From a study of the literature it is thought that :—
(*a*) The disharmony of some cytological and genetic results in *Pisum* is possibly due to genetic changes in the crossing-over value and to the non-identity of the genes concerned in the different varieties worked upon. Crossing-over takes place with about the same frequency for male and female gametes.
(*b*) In *Zea mays*, the crossing-over value for different regions of a chromosome may differ significantly among different families. Some families are more uniform than others as regards stability of crossing-over. In plants heterozygous for a factor, crossing-over was much lower than for homozygous plants. Female gametes on tiller ears shew a higher crossing-over value than female gametes of ears on the main stalk. Sex probably influences crossing-over, the percentage generally being higher for the male than for the female gametes though the latter shew slightly greater variability.

172. 575.243:538.6
Pirovano, A. 635.62:575.243
Genetic mutations produced by electro-magnetic induction and X-rays.
Int. Rev. Agric. Rome 1932 : **23** : 330–38.
The plants to be treated were placed between the poles of an electro-magnet and subjected to inductions of various frequencies. The effects were much less injurious than those of X-rays and radium. Low power and prolonged action gave the best results.

The pollen of a homozygous strain of *Cucurbita Pepo* var. *cucurbitella* was treated and used afterwards for pollination. The fruits ripened normally and germination was good.
Various mutants appeared in F_1. Among them were plants of greater productivity and earlier maturity than the controls. Certain of these mutants have remained stable for 9 generations.

173. SINSKAIA, E. N. 576.16
(The study of species in their dynamics and interrelation with different types of vegetation.)
Bull. Appl. Bot. Leningrad 1930–31 : **25** (2) : 1–97.

The species concept is discussed from a general point of view. Both gene mutation and recombination by hybridization and chromosome changes are shewn to be essential processes in evolution. However this may come about, quite definite and peculiar conditions are essential for the process to carry on to completion. These are, amongst others, a combination of climatic and other conditions favourable for the survival of the new types. It is significant that the known centres of form development are characterized by very uniform ecological conditions. A study of the apparent area of species development of *Brassica* confirms this.
With the migration of the forms from these areas begins the process of ecological differentiation. If the ecological conditions of the central area change, then the process of differentiation occurs there also and many of the original forms are lost. This has occurred with the subspecies *oleifera* of *B. campestris*. Similarly many plants would have disappeared altogether but for their being preserved under cultivation.
A species passes through three stages : undifferentiated stage, where its gene potentialities are however at the maximum ; the period of increasing polymorphism, the greatest number of genotypical combinations but not necessarily the greatest store of genes ; then the period of decadence, resulting from the gradual impoverishment of its genes.
The evolution of species has therefore been very intimately affected by changes in conditions of the earth's crust. Any catastrophe giving rise to large tracts of country favourable to the survival of new forms has given tremendous impulse to specific evolution, which slowed down again as the tract became populated.

BOTANY 581

174. YASUDA, S. 581.162.5
Physiological researches on the fertility in *Petunia violacea*. X. On the relation between the self-incompatibility and the tissue juice of the ovary.
Bot. Mag. Tokyo 1932 : **46** : 510–17.

The " special substance " inhibiting the germination or growth of the pollen grains or pollen tubes on their own stigmas has been found by the author to be produced by the placenta in *Petunia violacea*.

175. GRUBER, F. 581.162.5:575.242
Ueber die Verträglichkeitsverhältnisse bei einigen selbststerilen Wildsippen von *Antirrhinum* und über eine selbstfertile Mutante. **(On the compatibility relations in some self-sterile wild strains of *Antirrhinum* and in a self-fertile mutant.)**
Z. indukt. Abstamm.- u. VererbLehre. 1932 : **62** : 429–62.

The results suggest that here as in *Nicotiana* and *Veronica* self-sterility is due to the interaction of genetical factors.
The appearance of a self-fertile plant in a cross between two self-sterile individuals is attributed to a gene mutation.

176. GESCHER, N. v. 608.3
Protection of the plant breeder's rights.
Int. Rev. Agric. Rome 1932 : 23 : 199–207.

At present, in spite of the immense value of his work, the plant breeder reaps no material reward for the production of new and improved varieties. Some form of protection would probably have a stimulating effect.

Control by the State or by the agriculturist himself are possible measures and various forms of legislation are being applied by several countries. In America plant patents may be obtained for inventions but the law applies only to horticultural products. In France and Germany there exists a system of registration if the varieties in question are superior to those from which they were derived or shew new and really valuable characteristics.

An international agreement is also desirable.

AGRICULTURE 631

177. REINHARDT, F. 631.421
Der Jahresfehler bei Feldversuchen. (**The yearly error in field tests.**)
Arch. Pflanzenbau 1931/32 : 8 : 187–275.

The author examines a large mass of numerical data relating to the yields of a number of the common agricultural crops under varying manurial treatments, and extending over a considerable number of years. He is concerned with the seasonal error, and by statistical methods is able to assess the reliability of mean yields determined over various periods. For the probable error to be reasonably low, the author concludes that it is not enough to conduct an experiment for a period of three to five years, but that at least nine years of continuous experimentation is required. Methods of examining manurial differences by adjusting for seasonal variations are discussed.

178. KRISTENSEN, R. K. 631.421:519.24
Ausgleichung und Fehlerberechnung beim Feldversuch. Eine kurzgefasste Darstellung. (**Compensation and the calculation of the error in field tests. A brief presentation.**)
Arch. Pflanzenbau 1931/32 : 8 : 436–55.

Various methods of lay-out common in Scandinavia are discussed in relation to the calculation of the experimental error. These are systematic arrangements, but for the rest they follow the same development as those of R. A. Fisher, in the sense that the effect of introducing more and more restrictions on the placing of the plots has to be allowed for. A formula for the calculation of the error, which does not appear to be proved, is given, and particular cases are worked out. It is interesting to note that the denominator agrees with the number of degrees of freedom in the analysis of variance in the special cases of grouped samples, randomized blocks and the latin square, but is non-integral in more complex cases, although very near to the integral value which would result from treatment by means of the analysis of variance, the valid method for randomly arranged experiments.

179. IMMER, F. R. 631.421:519.24:633.63
A study of sampling technique with sugar beet.
J. Agric. Res. 1932 : 44 : 633–48.
Size and shape of plot in relation to field experiments with sugar beet.
J. Agric. Res. 1932 : 44 : 649–68.

These two papers are detailed statistical studies of much general interest. In the first an examination was made of data obtained by a sampling procedure for the determination of sugar percentage. The latter was shown to be related to the weight of roots by a regression that was not entirely linear, and when allowance was made for this regression soil heterogeneity was found to affect the sugar percentage significantly. The size of sample in relation to the accuracy desired was discussed. In the second paper the data of a large uniformity trial when analysed gave information as to the best size and shape of plot to take. The relationship between weight of roots, sugar percentage and apparent purity was also determined. Interesting contour maps of fertility are reproduced.

631.421:633.61

180. **International Society of Sugar Cane Technologists, Fourth Congress, March, 1932.**

A number of the bulletins issued in connection with this congress deal with the statistical principles underlying the science of field experimentation, e.g., nos. 14, 15, 16, 17, 47, 53, 55 and 82.

DISEASES 632

181. BAUCH, R. 632.451.2:577.8
Die Sexualität von *Ustilago Scorzonerae* und *Ustilago Zeae*. (**The sexuality of *U. Scorzonerae* and *U. Zeae*.**)
Phytopath. Z. 1932 : **5** : 315–21.

By using a suitable medium *Ustilago Scorzonerae* and *U. Zeae* have been induced to shew a sexual reaction.

U. Scorzonerae shews a bipolar sexuality and for *U. Zeae* six sterility and two sex factors have been determined.

182. BAUCH, R. 632.452:577.8:575.11
Ueber die genetischen Grundlagen von Zwittrigkeit und heutralen Verhalten bei Brandpilzen. (**On the genetical basis of hermaphroditism and neutral behaviour in rust fungi.**)
Planta (Berl.) 1932 : **17** : 612–40.

It is shewn that the occurrence of hermaphrodite and neutral strains in the normally dioecious *Ustilago longissima* is due to irregularities in the reduction division by which the A and B factors influencing sex, which are probably localized in different chromosomes, are irregularly distributed.

ECONOMIC PLANTS 633

183. SINSKAIA, E. N. and BEZTUZHEVA, A. A. 633:576.16:632.51
(**The forms of *Camelina sativa* in connection with climate, flax and man.**)
Bull. Appl. Bot. Leningrad 1930–31 : **25** (2) : 98–200.

The plant is a common weed in flax fields. Both plants display a marked regional variation in a number of characters which vary together, although they are not linked. The authors conclude that the parallel variation in the two plants is a result almost entirely of the effect of climate, corresponding genotypes being selected in the respective regions. With regard to certain characters which are not influenced by climate, such as branching, thickness of stem, etc., the correspondence evidently results from a selection of those forms most resembling flax. The correspondence in size of seed also has evidently resulted from selection through winnowing of the flax seed. In cultures of shattering flax, and nowhere else, a peculiar shattering form was observed.

In some districts the equilibrium between the weed and the flax seems to be disturbed and the *Camelina* entirely supplants the latter. This is how many of the present crop plants are thought to have entered into cultivation.

184. SCHICK, R. 633:581.143.26.035.1:575
Photoperiodismus. (**Photoperiodism.**)
Züchter 1932 : **4** : 122–35.

The study of photoperiodism began with some observations of Garner and Allard in 1906. Since then the subject has developed rapidly in many directions and is now of practical importance to the plant breeder.

Different varieties and strains shew different reactions to the same length of day and it is probable that the differences are inherited. The bolting or not bolting of lettuces was dependent on

length of day in one strain and not in another and this character was inherited on Mendelian lines. Control of length of day makes it possible to control the time of flowering of plants and so to effect hybridizations which might otherwise be impossible.
A bibliography of 70 titles is appended.

185. GESCHER, N. v. 633–2–1.521.6:575
Practical immunisation of plants by genetic methods.
Int. Rev. Agric. Rome 1932 : **23** : 287–91.
A very general account of breeding for disease resistance.

186. ARTEMOV, P. K., SOLJAKOV, P. A. and PRUZKOVA, M. G. 633.00.14
(Methods of crop tests in the most important agricultural crops. Vols. I and II.)
Lenin Acad. Agric. Sci., Inst. Plant Ind., Division of Crop Tests, Leningrad 1932 : Pp. 382 and 230.
A description of the organization and objects of the work. The following are the characters which receive attention in judging the merits of a plant : yield, earliness, quality, resistance to drought, cold, fungus and insect attack, shattering and lodging, chemical composition.
The methods of carrying out the tests for various characters and for the different crops in turn are described.
The first volume deals with field crops, the second with vegetables.

187. OPITZ, K. 633.1:575(43)
Ertragsstatistische Untersuchungen über die Fortschritte der deutschen Roggen-und Weizenzüchtung auf der Grundlage vierjähriger Sortenprüfungen der Deutschen Landwirtschaftsgesellschaft. (**Statistical yield studies on the progress of German rye and wheat breeding on the basis of four-year variety tests by the Deutsche Landwirtschaftsgesellschaft.**)
Landw. Jb. 1932 : **76** : 155–79.
A sketch is given of the development of cereal breeding in Germany, with special reference to methods and organization of variety testing.
Attention is called to those sorts which, out of all the ones produced at the end of the last century, have continued to the present day. Petkus rye has throughout shewn a regular excess over the other sorts and the average yield of the sorts has shewn no material change.
The average yields of wheat on good land display a marked rise corresponding to the introduction of Squarehead types. Apart from this no rise in the average yields is observable, Strube's Squarehead again remaining almost constant. By comparing the yields of other varieties with that of the latter, however, a definite rise was detectable, although the differences between varieties remained as large as ever. The wheats grown on poor land shew a clear rise in average yield, an increase of 30 per cent in the last two decades being observable. The differences between the individual sorts have also fallen.

188. HÜTTIG, W. 633.1–2.451.2–1.521.6:575
Die Grundlagen zur Immunitätszüchtung gegen Brandpilze (Ustilagineen). [**Fundamentals of breeding for immunity to bunt** (*Ustilaginaceae*).]
Züchter 1932 : **4** : 209–19.
The sex phenomena characteristic of the fungus are summarized, followed by the influence of external conditions, temperature and moisture in particular, on infection, and the existence of physiological forms and mutations. In the final section the bearing of these results on breeding for resistance, etc., the results of inheritance studies and immunity breeding are reviewed.

189. 633.11 Gasta
BLEDSOE, R. P. 633.11:575.42(75.8)
A new wheat for Georgia, with suggestions for culture.
Bull. Ga. Expt. Sta. 1932 : **171** : Pp. 16.
A higher-yielding selection from Purplestraw.

190. 633.11(47)

DEKAPRELEVICH, L. A. and MENABDE, V. L. 633.11 *T. Spelta*:576.16

[Spelt* wheats of Western Georgia (Western Transcaucasia).]

Bull. Appl. Bot. Leningrad 1932 : 5th Ser. (1) : 3–46.

The wheats in question are *T. macha* sp. *nova*, *T. dicoccum*, *T. Timopheevi* and *T. monococcum*. An ancient cultivation of these wheats, including numbers of forms new to science, was revealed by these studies. They are of especial interest in the problem of the origin of the genus.

The distribution of *T. Timopheevi* is indicated. This wheat is very uniform and endemic to a very limited region. Results are given of hybridization of it with other wheats, shewing it to be clearly distinct from the other 28 chromosome wheats and from *T. monococcum*. It seemed to cross most successfully with *T. durum* and *T. persicum*.

The varieties of *T. monococcum* and *T. dicoccum* found are described. The latter is very rare and there occurs only one endemic, var. *chvamlicum*, so distinct as almost to merit separation into a new species. The authors create a new section of the species for it.

A new 42 chromosome species with brittle rachis is described under the name *T. macha* Dekapr. et Menabde, which although very restricted in distribution displays remarkable diversity. The rachis breaks in almost every case in the way characteristic of *T. dicoccum*. The hereditary variability of 15 ear characters and a number of vegetative characters is indicated.

Almost all the glume characters of the soft wheats are represented and this forms a further example of parallel variation. Certain individuals in many respects resemble *T. Spelta* but none are identical. Descriptions are given of 8 varieties.

There seems no doubt that this region is a centre of development of a certain section of the genus *Triticum*. It is not improbable that the 42-chromosome brittle forms are a relic of a more extensive and varied centre of development, of which the Afghan and Punjab wheats represent the most complete remains.

The discovery of this species leads the authors to conclude that it represents the basic polymorphic group, from which *T. Spelta* has originated later as a secondary relatively monomorphic group. These considerations support Vavilov's view of the Asiatic origin of the 42 chromosome wheats.

191. JAKUBZINER, M. 633.11(47.9)

(V. Contribution to the knowledge of wild wheat in Transcaucasia.)

Bull. Appl. Bot. Leningrad 1932 : 5th Ser. (1) : 147–98.

Wild *Triticum dicoccoides* and *T. monococcum* was found in the neighbourhood of Azerbaidjan. The racial diversity was less than that of the Palestine wild emmers.

An elaborate analysis of 114 characters shews that *T. dicoccoides* resembles *T. dicoccum* in very few—only about 10—shewing much closer resemblance to the wild *T. monococcum* found in the same region. The Armenian group also differs considerably from the Palestine group and is separated as a distinct sub-species, *armeniacum*. Both these sub-species are divided into a number of groups.

Natural hybrids of the Palestine wild emmer with *T. vulgare* have been observed at the experimental station, having chromosome numbers of 37, 32 and 39.

The wild emmers have many characters in common with *T. Timopheevi*.

The present findings leave no doubt that Transcaucasia is also an independent centre of form development for *T. dicoccoides*.

The wild einkorns were possessed of most of the features characterizing the wild emmers of this region. Amongst them were forms with green grain, a character also observed in certain of the varieties of *T. aegilopoides* occurring.

Species of *Aegilops* were found in all parts of the region under investigation.

The whole question of the genetics and systematics of the genus *Triticum* may be altered by the

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* This is the author's translation of the Russian "Plenchatye" meaning "those having attached glumes" and therefore does not refer to *T. Spelta*.

discovery of the species in these new stations, together with the botanical and ecological characteristics and diversity of the *T. dicoccoides* species and the close relation between them and *T. monococcum.*
Moreover these wild forms, on account of their extreme tolerance of rigorous conditions of growth, are of great value for breeding, being a " reservoir of resistant genes."

192. 633.11(56.6)
TROITZKY, N. A. 633.11:576.16
(Botanical characteristics of the habitats of wild wheats in Armenia.)
Bull. Appl. Bot. Leningrad 1932 : 5th Ser. (1) : 53–68.
An account is given of the ecological conditions and the plants associated with the wild species *Triticum aegilopoides* and *T. dicoccoides.* This proves to be a group of semi-weed plants, which at an early date became synanthropous. There seems little doubt, from the nature of the associates of the wild wheats and the ecological conditions of their habitat, that they do represent an aboriginal element of the local flora. It is just such a type which Vavilov envisages as the ancestors of the cultivated wheats.

193. BOEUF, F. 633.11:575.11
Le blé en Tunisie. **(Wheat in Tunisia.)**
Ann. Serv. Bot. et Agron. Tunis 1932 : **8** : Pp. 454.
A review is given of the question of the systematics and genetics of *Triticum* in the light of the recent researches of many authors. The wheats of Tunisia, mostly *T. durum*, are discussed from the point of view of Vavilov's centre of origin theory, N. Africa being regarded as a secondary centre.
A description is given in some detail of each of the main types cultivated, both *durum* and *vulgare*, together with indications of the characters of certain promising hybrids.
The methods and problems of breeding are described in considerable detail ; especially the problem of pure lines, the reality of which is defended on experimental grounds.
Numerous cases of out-crossing are referred to, both in the author's own experience and in the work of other investigators.
An account is given of the inheritance of a number of characters in intervarietal crosses, including density and other ear characters, various degrees of awn development, pubescence, colour of ear and grain, the speltoid type, and straw characters—strong straw appeared to be linked with dense, undesirable type of ear ; the inheritance of hollow versus solid straw was also included in these studies. Under the study of the inheritance of physiological characters in these crosses were included the spring versus winter habit, rust resistance and baking quality, for all of which however no clear factorial scheme was applicable.
Brief indications are given of the inheritance of certain characters in *T. durum*, then of interspecific crosses involving species of the same chromosome number—viz. *T. vulgare* x *T. sphaerococcum* ; *T. durum* x *T. persicum*, *T. pyramidale* and *T. turgidum.* Certain anomalous results are ascribed to the possible impurity of some of the races used as parents. The phenomenon of " shift " was observed in the cross *T. durum* x *T. persicum.*
Crosses between species differing in chromosome number next come under consideration, starting with the pentaploid hybrids. The work of previous authors is reviewed, the author's own results being fitted in in the appropriate places. Transgressive segregation in the direction of susceptibility to rust occurred in crosses of *T. durum* x *T. vulgare*, but in the reverse direction it was not observed. The author expresses scepticism as to the practical utility of the pentaploid hybrids. In the same way the literature on the other types of interspecific crosses and on intergeneric crosses is summarized, followed by brief indications of the present opinions on the origin of the wheat species and the light shed on this by the Russian studies of distribution, etc.
The remaining part is devoted to an outline of the problems with which the breeder in Tunisia is faced, and the methods of solving them. The merits of pure line selection are emphasized. In making selections little importance is attached to tillering, the number of fertile flowers per spikelet being regarded as of prime importance.

Attention is next directed to the increased improvement which can be brought about by hybridization, especially after a study of the geographical distribution of the required genes. It is a rule always to use a local race as one of the parents. Indications are given of the methods of carrying out the hybridization and the testing of the new lines.
Some of the hybrids now under examination are of promise in that they combine earliness with strong straw, high productivity, resistance to drought and shedding. Some of them appear to be of high baking quality.
In crosses of *T. durum*, mainly with the object of increasing the earliness, those involving other species, even with the same chromosome number, have not been successful on account of the susceptibility to rust which has always resulted. There is therefore much less scope for improvement by hybridization in *T. durum* than in *T. vulgare*.
Regret is expressed that certain of the local races of *T. vulgare* have been allowed to be lost.

633.11:575.11.061.2:581.46
194. STEWART, G. and DALLEY, C. L. 633.11:575.11.061.6:581.46
A cumulative transgressive segregation in wheat.
J. Amer. Soc. Agron. 1932 : **24** : 755–64.
In a cross between the dense-eared, white-grained and fully awned variety, Utac, and the lax-eared, red-grained and short-apically-awned variety, Ridit, inheritance of ear density was studied. The homozygous, dense-eared group in F_3 was more dense than the dense-eared parent and similarly the homozygous, lax-eared group was more lax than the lax-eared parent, the differences being statistically significant. Thus transgressive segregation occurred in both directions but it was particularly marked in the direction of greater laxness. Nevertheless the author explains the results on a one-factor basis and gives figures in support of this. Difference in length of awns was also caused by a one-factor difference, giving a 1 : 2 : 1 ratio, but grain colour was controlled by two factors, giving a 15 red : 1 white ratio.

195. 633.11:575.11.061.2:581.46
STEWART, G. and NELSON, L. W. 633.11:575.11.061.6:581.46
Recurrence of a peculiar genetic recombination in the spike density of wheat.
Amer. Nat. 1932 : **66** : 207–22.
The parents were Sevier with a mid-dense spike and Ridit with a lax spike. F_1 resembled Sevier and there was transgressive segregation in F_2 in both directions. The average spike density of the parents was 44.58 mm. for Ridit and 33.9 mm. for Sevier, the three groups of F_3 progeny homozygous dense, homozygous lax and heterozygous had average spike densities of 23.6, 52.83 and 34.75 mm. respectively. The segregation into the three classes indicated a 1 : 2 : 1 ratio. The degree of transgression suggested that minor factors are also involved. No plants with the spike density of Sevier were recovered in F_3 and only once a plant with that of Ridit. One factor was found for glume colour and two for kernel colour. There was segregation of awns in F_2 in a 1 : 2 : 1 ratio.

196. ELLIOTT, J. W. 633.11:575.113.4–181.12:581.46
A factorial analysis of some quantitative characters in a cross between *T. vulgare* var. Sonora and *T. compactum* var. Club C.I. 4534.
J. Amer. Soc. Agron. 1932 : **24** : 764–78.
Spike length was apparently less influenced by environment in Club than in Sonora. F_1 was intermediate but nearer Sonora, *i.e.* Sonora was partially dominant to Club in respect of this character. F_2 ranges exceeded the parental ranges at both extremities, unlike the results obtained by previous investigators with *vulgare—compactum* crosses. It is concluded that two factors are concerned and one of them, probably contributed by Sonora, has a greater influence on length of spike.
No genetical difference between the parents in number of spikelets per ear could be detected.

197. BRESSMAN, E. N. 633.11:575.114
Spillman's work on plant breeding.
Science 1932 : **76** : 273–74.
A reference to wheat crosses in which the principle of segregation was demonstrated for various characters shortly before the rediscovery of Mendel's laws.

198. BERG, K. H. v. 633.11:575.127.2:576.356.5
Ein Bastard mit vier, vollständigen, haploiden Artgenomen. (**A hybrid with four, complete, haploid species genoms.**)
Anz. Akad. Wiss. Wien 1931 : **68** : 226–28.
A cross was made between *Aegilotricum* and *T. turgidovillosum* (see " Plant Breeding Abstracts " Vol. I, Absts. 164 and 320). The F_1 hybrid therefore contains the full genoms of *Aegilops ovata*, *Triticum durum*, *T. turgidum*, each consisting of 14 chromosomes and *T. villosum* with 7. The hybrid is thus to be regarded as heptaploid (7n).
The chromosomes of *T. turgidum* and *T. durum* pair but the remaining 21 remain as univalents. The number of bivalents varies between 12 and 14 just as in hybrids of *T. durum* by *T. turgidum*. In spite of the fact that these chromosomes have a normal meiosis, giving germ cells with a full set of 14 and varying numbers of univalents, the hybrid was practically sterile, on account of the failure of the anthers to open. By artificially opening them a few successful pollinations were made.

199. CHIZAKI, Y. 633.11:575.127.5.633.11 *Aegilops*:576.356
Chromosome studies of F_1 *Aegilops speltoides* x *Triticum monococcum*
Bull. Utsunomiya Agric. Coll. 1932 : **2** : 43–47.
One F_1 was obtained, resembling the maternal (*Aegilops*) parent in the majority of its characters. The hybrid was sterile.
In the pollen mother cell 2–3 bivalents were observed with greatest frequency and occasionally higher numbers, up to the total 7. A few further irregularities were observed.

200. ERITZIAN, A. 633.11 *T. macha*:576.312.32
(**Contribution to the cytology of the spelt wheats of Georgia.**)
Bull. Appl. Bot. Leningrad 1932 : 5th Ser. (1) : 47–51.
The cytological analysis is given of four forms of the new species *T. macha* Dekapr. et Menabde, referred to in Abst. above. Forms differing considerably in type were chosen and all proved to have 42 chromosomes. Definite characteristic morphological features distinguished certain chromosomes and these were never represented more than twice in one somatic plate. Hence an allopolyploid and not autopolyploid nature is argued for these wheats.

201. KIHARA, H. and KATAYAMA, Y. 633.11 *monococcum*:576.356.52:581.163
(**On the occurrence of haploid plants in *Triticum monococcum***)
Kwagaku, Japan 1932 : **2** : 408–10.
Three haploid plants occurred in 1932. One originated under normal conditions, the other two were the results of irradiation during the maturation division. They shewed as expected, 7 univalents at the first reduction division.
The haploid plants were smaller than the normal diploid plants.
A parthenogetical origin is suggested.

202. BRIGGS, F. N. 633.11–2.451.3–1.521.6:575.11
Inheritance of resistance to bunt, *Tilletia tritici*, in hybrids of white Federation and Odessa wheat.
J. Agric. Res. 1932 : **45** : 501–05.
A study of the F_2 of the cross between the susceptible White Federation and the resistant Odessa indicated that the latter possesses a single dominant factor for resistance to *Tilletia tritici* (" Physiologic Race III "). This conclusion was supported by the results of F_3 plantings.

203. PETROPAVLOVSKY, M. T. 633.13(47)
(Cultivated oats of U.S.S.R.)
Suppl. 45 Bull. Appl. Bot. Leningrad 1931 : Pp. 138.
A study of the varietal composition of the oats under cultivation, the geographical arrangement of the various races and the geographical distribution and variability of the most important botanical and agronomic characters. The different regions of the U.S.S.R. are then taken individually and the forms characterizing them indicated.
The oats in all regions are extremely mixed. This makes it necessary for some improvement to be effected in the type and the very heterogeneity of the crop at the present time makes it probable that by selection it will be possible to produce extremely valuable forms suited to each respective region ; early maturity and increased productivity are the first essentials. There are indications that in this way the northern limit of oat cultivation will be considerably extended.

204. 633.13:575.127.2:576.356.7
KIHARA, H. and NISHIYAMA, I. 575.127:581.162.5
The genetics and cytology of certain cereals. III. Different compatability in reciprocal crosses of *Avena*, with special reference to tetraploid hybrids between hexaploid and diploid species.
Jap. J. Bot. 1932 : **6** : 245–305.
The results of crossing various species in different combinations are presented. Hybrids of *A. fatua* x *A. strigosa* produced no functional pollen as the anthers did not dehisce ; a few female gametes were functional. At meiosis in both this and the other tetraploid hybrid *A. sativa* x *A. strigosa* the number of pairs varied from 3 to 9 and various higher complexes were also observed. A certain amount of autosyndesis evidently occurs therefore. Close observation shewed conjugation to be somewhat weaker in the *fatua* than in the *sativa* hybrid.
The course of meiosis is described. The univalents pass to the equatorial plate, divide and pass to the poles after the corresponding movement of the bivalents. Occasional lagging univalents fail to divide or are left out of the diad nuclei formed.
The development of the embryos is described briefly for *A. strigosa* and *A. fatua* and in their reciprocal hybrids. In the *A. strigosa* x *A. fatua* cross development is almost normal except that it is extremely rapid and the endosperm develops irregularly and ultimately a degeneration sets in. In the reciprocal cross the degeneration was much more pronounced and very few embryos developed normally. The relation of male to female genoms is much reduced in the cross *A. fatua* x *A. strigosa*, in comparison with the ratio in the parental species and the reciprocal cross ; this destruction of the balance is thought to be the probable cause of the abnormal development, the stimulating action of the male nucleus being unduly weak in the first case and in the second unduly strong, leading to excessive development and the production of non-viable seeds. The results of crosses in other species differing in chromosome number are re-examined from this point of view.

205. HOOVER, M. M. and SNYDER, M. H. 633.13:581.162.32
Natural crossing in oats at Morgantown, West Virginia.
J. Amer. Soc. Agron. 1932 : **24** : 784–86
The amount of natural crossing observed in Fulghum oats (*A. byzantina*) was 0.66 per cent in 1929 and 0.41 per cent in 1930. Investigations shewed that a greater amount occurred in the secondary florets than in the primary or tertiary.

206. COTTER, R. U. 633.13–2.452:576.16:575.12
A new form of oat stem rust from a barberry area.
Phytopathology (Abst.) 1932 : **22** : 788–89.
A form of the fungus hitherto unknown was found on a barberry plant, before infection became general on the oat plants. It is thought probable that the new form arose by hybridization.

207. 633.14 Toivo
PESOLA, V. A. 633.14–1.524.4:575.12(47.1)
Toivo-ruis. **(Toivo rye.)**
Valtion Maatalouskoetoiminnan Tiedonantoja 1931 : No. 21 : Pp. 15.
A new strain of rye produced by the Division for Plant Breeding (Jokioinen) of the Central Experiment Station of Finland is described. It originated from a cross of Belgian Campiner rye with a local Finnish race. It excels the latter in strength of straw and grain quality and outyields both local and the best Scandinavian and German ryes by 5—15 per cent.

208. COTTER, R. U. and LEVINE, M. N. 633.14–2.452:576.16:575.12
Physiologic specialization in *Puccinia graminis secalis*.
J. Agric. Res. 1932 : **45** : 297–315.
Fourteen physiological forms of *Puccinia graminis secalis* have been distinguished.
New forms may arise by hybridization between *P. graminis secalis* and *P. graminis tritici*.

209. KEMP, W. B. 633.15:575
The present status of corn breeding.
Rep. Md. Agric. Soc. 1931 : **16** : 316–19.
It has been proved that only a slight increase in yield is to be looked for as the result of selection.
The crossing of inbred lines and the hybrid vigour so obtained is a more successful but costly method.
The production of double hybrids is less expensive and equally productive.
Seed produced by one or other of these methods will soon be a commercial proposition.

210. EMERSON, R. A. and ANDERSON, E. G. 633.15:575.113.3.061.6
The A series of allelomorphs in relation to pigmentation in maize.
Genetics 1932 : **17** : 503–09.
Data are presented for the inheritance of the dominant brown pericarp, shewing that there is no recombination between this gene and A, to which it is dominant and with which it is therefore allelomorphic. It is therefore designated A^b. It resembles A in its effect on the plant colour.
A further allelomorph a^p is shewn to exist, whose effect is like a on plant colour, like A^b on pericarp colour and intermediate between A and a on aleurone colour.
The P^p factor pair is shewn to be independent of the A group.
The dominance relationships of the four A allelomorphs are therefore different in respect of the different characters they influence. Their effect in combination with various other genes is indicated.

211. MANGELSDORF, P. C. 633.15:575.114:578.088.2
Mechanical separation of gametes in maize.
J. Hered. 1932 : **23** : 289–95.
A gene for small pollen grains was closely linked with starchy endosperm. The pollen consists of approximately equal numbers of large and small grains, the latter of which fail to accomplish fertilization. The amount of starchy in the offspring was only 6 per cent and this corresponded to the amount of crossing over between the two genes.
By sifting the pollen and separating the small grains, which were then used for pollination, the proportion of sugary was reduced to 25.9 per cent by this method.
There is still evidence that the grains with the *normal* gene even when of the same size, compete more favourably with those with the *tiny* gene.
It is suggested that artificial control of the ratios by these means may be a valuable aid to plant breeding.

212. HAYES, H. K., JOHNSON, I. J. and CRIM, R. F. 633.15:575.125
Double-crosses of corn for distribution in Minnesota.
Bull. Minn. Agric. Expt. Sta. 1931 : **275** : Pp. 14.
The modern method of corn breeding in which inbreeding is first practised to obtain pure lines the best of which are later combined by crossing, is explained. Three promising double-crosses

which are being distributed to farmers are described. Earlier and more uniform maturity is a valuable characteristic of these. It is thought that advanced-generation crosses may yield as much as double-crosses.

213. EMERSON, R. A. and BEADLE, G. W. 633.15:575.127:575.116.1
Studies of *Euchlaena* and its hybrids with *Zea*. II. Crossing over between the chromosomes of *Euchlaena* and those of *Zea*.
Z. indukt. Abstamm.-u. VererbLehre. 1932 : **62** : 305–15.

Crossing over in respect of 8 different chromosomes was studied in hybrids of maize and Durango teosinte and proved to be of exactly the same order as that which occurs between maize chromosomes themselves, except in the C–wx chromosomes, where no crossing over occurred.
In hybrids with Chalco teosinte crossing over equal to that in maize occurred in the C–wx chromosome as well as in the 5 other chromosomes studied. With Florida teosinte again, however, no crossing over in the C–wx chromosome occurred, although crossing over proceeded normally in the other 3 chromosomes tested.
Evidence of crossing over was even obtained from crosses of maize with the tetraploid *Euchlaena perennis*.
Inversion of a section of the c–Wx chromosomes of the Durango and Florida teosintes is a suggested reason for the failure of crossing over.

214. BEADLE, G. W. 633.15:575.127:576.354
Studies of *Euchlaena* and its hybrids with *Zea*. I. Chromosome behavior in *Euchlaena mexicana* and its hybrids with *Zea mays*.
Z. indukt. Abstamm.– u. VererbLehre. 1932 : **62** : 291–304.

The chromosomes of the *Euchlaena* parent are described, from which it is seen that they are very similar to those of maize, although certain differences are pointed out. Pairing was complete and meiosis quite regular in the hybrid with Chalco or Durango teosinte, 2 and sometimes 4 unpaired chromosomes were observed when Florida teosinte was used, in which case size differences could be detected between the chromosomes which failed to pair. It is suggested that these chromosomes may have been replaced by maize chromosomes in the 2 other forms, as a result of crossing with maize. This would account for the complete pairing.
A certain amount of sterility and pollen deficiency was observed in the Florida hybrids.
The hybrid of Florida with Durango teosinte was more irregular than that with maize, varying numbers of lagging univalents being observed and a higher degree of pollen sterility. These 2 can therefore be regarded as distinct species and the idea of the intervention of maize in the origin of Durango from Florida teosinte is discountenanced.

215. SPRAGUE, G. F. and POPE, M. N. 633.15:575.242.061.63
A case of two simultaneous mutations for virescent seedlings in maize.
Amer. Nat. 1932 : **66** : 284–85.

Among the ears tested for albino segregations was one which unexpectedly segregated for both albino and virescent seedlings. Such a result is explained on the assumption of the occurrence of two simultaneous mutations for virescent seedlings, there being no evidence of contamination by a stock carrying two virescents.

633.15:576.16
216. COLLINS, G. N. 633.15*Euchlaena*
The rediscovery of teosinte in Guatemala.
J. Hered. 1932 : **23** : 261–65.

A letter is reproduced describing the finding of wild *Euchlaena mexicana* abundantly in abandoned cornfields.
Illustrations are also furnished.

217. Brink, R. A. and Cooper, D. C. 633.15:576.356:581.162.51
A structural change in the chromosomes of maize leading to chain formation.
Amer. Nat. 1932 : **66** : 310–22.

The M–sterile race of maize characterized by incompletely filled ears and about 24 per cent of abortive pollen grains, shewed 8 bivalents and an open chain of 4 chromosomes at diakinesis. Its peculiar behaviour when selfed or reciprocally crossed to normal maize is explained by assuming that in M–sterile plants a terminal segment of one chromosome has become detached from its normal position and affixed by the broken end to a non-homologous whole chromosome.

218. 633.15:577.841:575.11
Richey, F. D. and Sprague, G. F. 633.15:581.145.1.02
Some factors affecting the reversal of sex expression in the tassels of maize.
Amer. Nat. 1932 : **66** : 433–43.

Length of daily light period and temperature are important, shorter daily periods and lower temperatures tending to bring about the development of silks in the tassels, and the opposite conditions conducing to normal sex expression. Strains differ in their liability to sex-reversal and the study of the F_2 and a backcross of two of the three inbred strains investigated indicated a single major factor difference between them (the recessive determining the greater tendency to reversal) ; accessory genes were probably also involved.

219. Holbert, J. R. 633.15:581.1:575
Importance of the physiological viewpoint in a corn improvement program.
Bloomington, Ill, Pantagraph Printing and Stationery Co., 1932 : Pp. 12.

It is shewn that inbred strains may differ considerably in their heritable physiological reactions. Some strains, for instance, are able to make good growth and yield well on soils that have not a high proportion of phosphorus or have only a limited supply of nitrogen and potassium ; some are able to make better use than others of supplies of nutrient materials. Strains that can germinate and grow at low temperatures are important, as well as those that can resist early frosts during the ripening period.
Improvement can also be effected by the choice of strains for breeding that are resistant to *Diplodia* and to lodging.

220. Bonvicini, M. 633.15:581.46:575
Sulla ereditarietà di una anomalia nel mais. (**On the inheritance of an anomaly in maize.**)
Ital. Agric. 1932 : **69** : 716–22.

In certain races of maize, plants were observed in the ears of which the paleæ were developed to a greater or lesser extent, in some cases entirely enclosing the grain. This anomaly persisted in some races from year to year but was most marked in years of drought when the phenomenon also occurred in races which had not already shewn it.
It is therefore concluded that the anomaly is inherited in some cases but is influenced and may even be produced under conditions of drought in races which do not possess the character.

221. Tschermak-Seysenegg, E. 633.16–2.112–1.521.6:575
Eine beachtenswerte zweizeilige Wintergerste. (**A noteworthy two-row winter barley.**)
Dtsch. landw. Pr. 1932 : **59** : p. 423.

The increased cultivation of winter barley in Central Europe has created the need for types characterized by cold resistance, earliness and reliability in yield. This has been fulfilled by numerous four-row barleys but high quality can only be obtained in a two-row barley, which the author is now attempting to produce. Crosses were made of Kirsche's two-row winter barley

with another two-row winter barley (resulting from the two-row Spring barley Hanna x the four-row winter barley Heines Riesen) characterized by earliness and high quality but lacking in hardiness. The hybrid was back-crossed with Kirsche's two-row. The barley so produced is winterhardy and early, having short strong straw and large grains, with extraordinarily fine husk. By continued selection types with grain indistinguishable from spring barleys have been procured, containing only 8—10 per cent protein and giving satisfactory yields.
From the later cross of Holleschauer spring barley (of the Hanna series) with Bestehorns two-row winter barley a type with still finer husk but somewhat less early has emerged.
The yields per hectare were only 1·7 dg. less than that of four-row barleys and the market value much higher.

222. Rodenhiser, H. A. 633.17–2.451:575.12
Heterothallism and hybridization in *Sphacelotheca sorghi* and *S. cruenta*.
J. Agric. Res. 1932 : **45** : 287–96.
Both *Sphacelotheca sorghi* and *S. cruenta* were found to be heterothallic.
By crossing monosporidial lines of two physiological forms of the same or of different species, hybrid chlamydospores were formed in the host plant. In the intraspecific crosses the sori resembled the original species, in the interspecific crosses the characters of *S. cruenta* were dominant.

223. Karper, R. E. 633.177:575.242–181.13
A dominant mutation of frequent occurrence in sorghum.
Amer. Nat. 1932 : **66** : 511–29.
A dominant, favourable mutation in a single gene causing an increase in height of about 40 per cent is reported in several inbred lines of kafir. The mutants are typical of the parental pure lines in which they appear in all characteristics save height ; when selfed the progeny segregates according to the ratio of 3 talls : 1 normal. The increased height is not due to hybrid vigour consequent upon outcrossing.
The several lines shew differences in the frequency with which the mutation appears but the average mutation rate for the whole series is 1 : 604.

224. Guščin, G. G. 633.18
(Rice.)
Lenin Acad. Agric. Sci., Inst. Appl. Bot. and New Cult., Leningrad 1930 : Pp. 281.
A brief account is given of the history of rice cultivation, of the wild species of the genus, some of which very closely resemble the cultivated rice, and various general questions. Full botanical descriptions are given of cultivated rice, *Oryza sativa* L. and the classification of its varieties.
The rice sorts in cultivation, of which there are more than in all the other cereals put together, are discussed and descriptions and illustrations given of those cultivated in the rice-growing districts of Russia, Italy, Japan, India and other rice-growing countries.
A section is devoted to breeding, where emphasis is placed on the necessity in the case of the rice plant of testing all new strains on the spot where they are designed to be cultivated, as regional differences have a very pronounced effect on the performance of the rice plant, more especially in the case of pure lines.
The various points which should receive attention in breeding are indicated, together with the technique of mass selection, pure line selection and artificial hybridization. These remarks are based almost entirely on reference to the literature.

225. 633.18:575(51)
(Report on experiments for improving rice cultivation and other studies.)
Bull. Dept. Rural Electrification, Foochow Electric Co., Ltd., 1932 : **2.**
The work of improving the local rice included pure line selection and a study of the varieties. Imported rices were also investigated, those giving the highest yields being selected and those of highest quality used for hybridization.

226. TERAZAWA, Y. 633.18 Aikoku:576.16
(On the origin and distribution of the variety " Aikoku " of lowland rice.)
Proc. Crop Sci. Soc. Japan 1932 : **4** : 190–99.
The author differs from Teshima in his views on the precise origin of Aikoku rice but both are agreed as to its having originated in the Miyagi Prefecture.

227. KONDO, M. ET AL. 633.18:581.143.26.035.1
[Studies on the photoperiodism in rice plant (First Report).]
Proc. Crop Sci. Soc. Japan 1932 : **4** : 25–44.
A Japanese version of the paper reviewed in " Plant Breeding Abstracts " Vol. III, Abst. 84.

228. TABATA, K., WOGATA, K. and SHIRAKAWA, M. 633.18:581.143.26.035.1
(On the effects of day-length upon the growth and the emergence of panicles in rice plants.)
Proc. Crop Sci. Soc. Japan 1932 : **4** : 226–44.
Under short periods of illumination early and late plants eared at approximately the same time, and only with increasing illumination period were the differences between late and early manifested. Therefore for hybridizing late and early varieties cultivation under reduced illumination period is recommended.

229. SAMPIETRO, G. 633.18–1.525(45)
Acclimatazione dei risi esotici nel nostro Campo Sperimentale. (**The acclimatization of foreign rices in our experimental ground.**)
G. Risicolt. 1932 : **22** : 126–28.
Forty-two varieties from eight different countries have been grown and of these, twenty-one will be resown for further trials and four multiplied for acclimatization.
These four come from Spain and Japan, rice-growing countries in the highest latitudes after Italy.

230. CHMELAŘ, F. and ŠIMON, J. 633.42(43.7)
Výnosnost zušlechtěných odrůd tuřínu podle pokusu v roce 1931. (**Yields of selected turnips according to the experiments of 1931.**)
Věstník (Bull.) Českoslov. Akad. Zeměd. 1932 : **8** : 207–12.
The performance of various sorts is reported. Some of the land races were promising and deserving of further breeding.

231. ŠIMON, J. 633.491(43.7)
Posuzování způsobilosti bramboru k jídlu a výběr vhodných odrůd hlavních, u nás žádaných typů jedlých bramborů. (**Judging the culinary quality of potatoes and choosing the best of those sorts most in demand.**)
Ceskoslov. Zemed. 1932 : **14**.
The great number of satisfactory sorts is an indication of the advances resulting from breeding but it is desirable that breeding be confined to the principal sorts and more attention be given to the improvement of quality.

232. STEVENSON, F. J. 633.491:575(73)
Potato breeding.
Amer. Pot. J. 1932 : **9** : 157–60.
Large co-operative tests are being carried out by a number of experiment stations. The new sort Katahdin is one of the ones upon which the greatest interest is centred ; it will take its place as a commercial variety in some states. It is highly resistant to " mild mosaic," produces better tubers than Rural, with shallow eyes, and a higher percentage of primes.
Breeding work of the ordinary kind is in progress. In addition an expedition to Mexico was organized to collect species of *Solanum*.
Seed sets more readily in the northern than in the other states and the co-operative programme enables crosses to be made here for testing in other states. As many as 40,000 seedlings were grown in all.

233. Tolaas, A. G. 633.491:575(73)
The value of ordinary field practices in determining the adaptability of new potato seedlings.
Amer. Pot. J. 1932 : 9 : 165–73.
A description of the methods used in testing new hybrids, with indications of the merits of some of the ones under test. The new sort Katahdin was very promising.

234. Rathlef, H. v. 633.491:581.331.2:575.1
Materialien zur Kenntnis des reifen Pollenkornes der Kartoffel. II. Der Erbgang der Pollenqualität. (**Materials towards the knowledge of the mature pollen grain of the potato. II. The inheritance of pollen quality.**)
Arch. Pflanzenbau 1932 : 9 : 344–88.
Material from a number of different sources was planted and studied with respect to the percentage of germinating pollen at 2 times of flowering. The differences between the different origins and between material grown at different places were inconsiderable. The quality of the pollen of various sorts was compared in this way. The degree of fruit production proved to be in the same order as the pollen quality. From these observations an indication is given of the percentage set to be expected from pollen of different qualities. Sorts with less than 30 per cent germinating pollen on the whole are useless as pollinators.
A certain pollen type devoid of protoplasm appears to be the result of inbreeding as it appears only in those sorts whose pedigree shews the same parent represented several times.
There follows an account of the pollen character of individual sorts with remarks on the origin of each, from which it is concluded that the present-day potatoes have originated from a number of various sources and species. From a comparison of the pollen of various parent sorts and their offspring an idea of the inheritance of pollen quality is obtained. Medium x medium seemed to give mostly poor pollen producers ; good x medium shewed clear signs of segregation. In good x good, mediums preponderated ; the best pollen resulted when the parents were not related ; in such cases also medium x poor gave an improvement in pollen quality. The expected results appeared at times to be disturbed by polyploidy. Poor x good gave only medium and good. There was thus a general tendency to reduction of the pollen quality and this was especially the case when the sort Daber entered into the parentage. The occurrence of high proportions of the particular type of pollen associated with the formation of restitution nuclei is characteristic of the Daber strains. A particular type of slit pollen grain is also characteristic of certain strains. Both these types are evidently hereditary and the suggested explanation is that the sorts responsible for their introduction belong to different species and their chromosomes therefore lacked affinity with those of the common European potatoes.
The importance of pollen studies before breeding is emphasized.

235. 633.491–2–1.524.2
Plant explorers back from hunt for disease-resistant potatoes.
Off. Rec. Wash. 1932 : 11 : p. 185.
An Expedition has returned from Chile, Peru, Bolivia and Chiloe with collections of indigenous potatoes for use in breeding, with especial reference to disease resistance.

236. 633.491–2.411.4:575.127.2
Schick, R. 633.491–2.411.4:576.16
Ueber das Verhalten von *Solanum demissum*, *Solanum tuberosum* und ihren Bastarden gegenüber verschiedenen Herkünften von *Phytophthora infestans*. (**The behaviour of *Solanum demissum*, *Solanum tuberosum* and their hybrids towards *Pytophthora infestans* of various origins.**)
Züchter 1932 : 4 : 233–37.
A culture of the fungus obtained from Streckenthin attacked the W races and their hybrids which had previously been immune (see " Plant Breeding Abstracts " Vol. I, Abst. 213), the only lines which were not attacked being certain hybrids of *S. demissum* x *S. tuberosum*.

The *S. demissum* parent and the F_1 proved to be immune to both this culture of the fungus and the ordinary Müncheberg form. Amongst the progeny from the backcross with *S. tuberosum* some were susceptible, others immune to the common form ; of the latter some were susceptible to the Streckenthin form. In the progenies of some of these F_2 plants however, certain plants resistant to both forms appeared. No reliable numerical relationships could be obtained.
These results clearly indicate the existence of at least 2 different physiological forms of the fungus. The existence of more is suspected.

237. SALAMAN, R. N. 633.491–2.411.4–1.521.6:575.127.2
Recent progress in the breeding of potato varieties resistant to blight (*Phytophthora infestans*).
2nd Cong. Int. Pathol. Comparée Paris, C.R. and Comm. 1931 : 435–37.
An improved technique for inoculation has shewn that up to 1928 no seedling of domestic varieties was immune to blight.
Crosses between the wild *Solanum utile* and domestic varieties have recently produced some seedlings resistant to blight and with the qualities of the domestic variety. The numbers of susceptible seedlings indicate that resistance is a recessive character.

238. PETRI, L. 633.491–2.8:575.1
Maculatura interna ereditaria dei tuberi di patata. (**Inherited internal speckling of potato tubers.**)
Boll. Staz. Patol. Veg. Roma 1931 (N.S.) : **11**: 171–75.
This disease can only be detected by cutting the tuber ; there are no external symptoms, either in the tuber itself or the parent plant. Such tubers used for seed produce, under favourable conditions, a vigorous and moderately productive plant but all the tubers shew the same defect and can only be used for pig food.
The disease which has been described in Germany under the name of Eisen– or Buntfleckigkeit can be placed in section V (pseudo-netnecrosis) of the virus diseases as classified by Quanjer. It is to be distinguished from internal brown spot or internal rust spot, partly by the shape of the markings but chiefly by the fact that it is inherited.

239. SARAKHOV, I. P. 633.51(47)
(Results of experiments with the cotton plant in 1929 at the Prikum experimental station.)
All-Union Sci. Res. Inst. Cott. Grow. and Cott. Ind. Tashkent 1931 : Pp. 28.
A collection of sorts was studied, with special reference to earliness and yield, and observations were made on the development of the respective sorts.

240. HARLAND, S. C. 633.51:575:016
The genetics of *Gossypium*.
Bibl. genet. 1932 : **9** : 107–82.
A very exhaustive review of the literature of cotton-genetics up to date, including remarks on the taxonomy and cytology of the genus. The characters are taken in turn and an indication given of the results of work done on their inheritance. The article is furnished with a bibliography and an index.

241. SZYMANEK, J. and GAVAUDAN, P. 633.51:575.127.2:576.312.35
Observations caryologiques sur quelques *Gossypium*. (**Karyological observations on *Gossypium*.**)
C.R. Acad. Sci. Paris 1932 : **194** : 123–25.
Crosses were made between *G. hirsutum*, varieties Hartsville and Allen, and *G. herbaceum*, var. Karangani and Garhohils. A few abnormally formed fruits were formed when Hartsville was used and perfectly normal F_1 plants produced. The crosses with Allen were not successful.
The characters of *G. herbaceum*, which was used as female, predominated but the characters of the other species were observable in the bolls and lint quality.

Chromosome counts were made on the parents and hybrid revealing 10–13 haploid chromosomes in *G. herbaceum*, 20–26 diploid in *G. hirsutum* Hartsville, 12 haploid in the F_1 hybrid. A self-fertilized line of Allen also shewed 20–26 diploid chromosomes, as in Hartsville, whereas the unselected Allen had this number in the haploid stage and as many as 50 in the somatic tissue.

242. Szymanek, J. 633.51:575.127.2:576.312.35
Observations caryologiques supplémentaires sur quelques *Gossypium*.
(**Further karyological observations on *Gossypium*.**)
C.R. Acad. Sci. Paris 1932 : **194** : 1011–13.

Diploid chromosome numbers of 20—26 are given for Ishan (*G. vitifolium*), 18—22 for Baronéli, 20—26 for Koriba (*G. punctatum*) and about 20 for *G. arboreum–sanguineum*.
The hybrids Ishan x Karangani (*G. herbaceum–indicum*) had 20—26 and Ishan x Saria (*G. punctatum*) 22—26.
These results confirm the opinion of the authors pronounced in the foregoing paper, of the existence of polyploidy within the *Gossypium* species.
The *G. vitifolium* x *G. punctatum* hybrid is said to be more resistant to climatic changes, diseases and pests, with lint sometimes better than the parents.
The hybrids again resemble the female more than the male parent.

243. Avtonomov, A. I. 633.51:575.42(47)
(**Investigation in Egyptian cottons.**)
Stud. Turkestan Plant Breed. Sta. Nihi, Sci. Ser. 1930 : No. 9/3 : 28 pp.

The Sea Island examined proved to be very heterogeneous in time of maturity and lint quality, certain individuals being as late as Sakelaridis, which also contained a certain number of early plants. These latter, however, were on the whole also inferior in lint qualities. A series of experiments was designed to study the possibility of obtaining early Egyptian types and a comparison of the growth phases and boll and lint production of Ashmouni and Upland types. Certain of the selected Upland types combined increased earliness with lint length equal or superior to the original stock. One line from the sort Janovich was 7—8 days earlier, with a lint length of 35.4 mm. ; another from Ashmouni was 3 days earlier, with lint 3 mm. longer than the original, giving yields 70—80 per cent of that of the standard sort Triumph Navrotskii.

244. Konstantinov, N. 633.51:581.143.26.035.1
(**The influence of period of illumination on the development of cotton.**)
Turkestan Plant Breed. Sta. Nihi, Popular Sci. Ser. 1930 : No. 10 : 18 pp.

Experiments were carried out on perennial forms of *Gossypium peruvianum* and *G. herbaceum*, the effect of varying length of day being observed. The greatest acceleration of flowering was observed in the plants with 10 hour illumination.
Various botanical forms, and sorts varying in earliness, were subjected to this period of illumination. It was found that the reduced length of day had the most effect on the latest ripening sorts and less and less on the earlier ones. The very earliest reacted hardly at all to reduced light.
The results of reducing the length of day are described in detail. The effects were produced by merely darkening the plant, complete darkness was not essential.
The importance of these results to the breeder in making hybridizations is pointed out and it is suggested that it will be possible to cross forms widely differing in time of maturity. A cross which may be of advantage for example is that between the perennial Peruvian types, with extreme boll size, with the Egyptian cottons. The F_1 progeny of such a cross is actually under observation.

245. Collings, G. H. and Wallace, R. W. 633.51:581.162.32
The extent of vicinism in cotton at Clemson College.
J. Amer. Soc. Agron. 1931 : **23** : 490–92.

Tests were made of green-leaved cottons at varying distances from a field of red-leaved cotton. Hybrid seeds were distinguishable in the seedling stage. At a distance greater than 40 feet no vicinism occurred and within this distance up to 10 feet only 16 hybrid seedlings amongst 2,075 were observed.

246. 633.51:677.21:575–181.12
KIDDER, A. F. 633.51:581.162.32
An unusual cotton plant.
Science 1932 : **76** : p. 295.
A plant was observed in which 15 to 20 fibres on each seed were 1¾ inches long, thus contrasting with the remaining fibres which were 1⅛ inches.
The origin of the plant was traced back to a natural cross between a native Peru cotton and an American Upland.

247. BURNHAM, C. R. 633.52–2.484–1.521.6:575
The inheritance of *Fusarium* wilt resistance in flax.
J. Amer. Soc. Agron. 1932 : **24** : 734–48.
The flax varieties studied were found to be highly resistant, completely susceptible or intermediate in reaction to *Fusarium lini* Boll. Crosses between resistant and susceptible varieties appeared to be intermediate in F_1 but the exact mode of inheritance could not be determined because of the large amount of variability. Crosses between susceptible varieties gave almost complete wilting while crosses between resistant strains unexpectedly showed a high percentage of wilt.
Linkage is suspected between susceptibility and one of the two factors for yellow seed coat colour.

248. 633.522:576.356.5
BRESLAVETZ, L. 633.522:576.312.332
Polyploide Mitosen bei *Cannabis sativa* L. II. (**Polyploid mitoses in *Cannabis sativa* L. II.**)
Planta (Berl.) 1932 : **17** : 644–49.
The normal somatic chromosome number is 20, but in the cells of the primary cortex of the root the number is regularly 40. This is true also of the secondary roots and is brought about by a coalescence of the cells. A pair of chromosomes distinguished by their large size are identified as the sex chromosomes.
Caryomeres and other irregularities were observed.

249. LEGASPI, T. T. 633.61:63.00.14
A comparative test of some promising college seedlings and two commercial varieties of sugar cane in the College of Agriculture.
Thesis No. 332. Expt. Sta. Contr. 1931 : No. 837.
Philipp. Agric. 1932 : **21** : 352–53.
Two of the college bred seedlings proved better than the commercial varieties M–1900 and Luzon White.

250. DAVIS, R. L. 633.61–2.8–1.521.6:575(72.95)
Mayaguez 28, 49 and 63. Three sugar cane varieties commercially resistant to mosaic.
Agric. Notes P. Rico 1932 : No. 61 : Pp. 6. (Stencilled).
Certain of the hybrids obtained from crosses of P.O.J. 2725 with S.C. 12/4 have proved to be resistant and satisfactory from a general point of view.

251. MCCRAY, F. A. 633.71:575.127.2
Compatibility of certain *Nicotiana* species.
Genetics 1932 : **17** : 621–36.
195 combinations between 21 species were attempted, and the new hybrids are described. Where the parents differed in chromosome number the cross was more successful if the species with the higher chromosome number was used as the female parent ; furthermore, the hybrids often more closely resembled the parent with the higher chromosome number, but the evidence for this is not so certain.

A consideration of the numbers of hybrids secured by crossing species within and between the 3 groups, *Tabacum*, *Rustica* and *Petunioides*, suggested that there is little or no relationship between the taxonomic position of the species and its ability to cross with other species.

252. McCray, F. A. 633.71:575.127.2:576.356.5
A partially fertile triple species hybrid in *Nicotiana*.
Genetics 1932 : **17** : 660–73.

The triple hybrid (*rustica* x *paniculata*) x *Langsdorffii* was partially fertile, and intermediate between *rustica* and *paniculata*, resembling the former rather more closely ; no definite *Langsdorffii* characters were observed. When crossed with *rustica*, the progeny produced clearly resembled *rustica* and were more fertile than the original triple hybrid. Cytological investigation of the latter revealed a larger number of chromosomes than were expected and the author accounts for this by assuming a doubling of the gametic chromosome number in the second division of the megaspore mother cell in the F_1, i.e., before the introduction of the *Langsdorffii* complement. The preponderance of *rustica* and *paniculata* chromosomes is given as the reason for the absence of *Langsdorffii* characters.

253. Singleton, W. R. 633.71:575.129:576.356.5
Cytogenetic behaviour of fertile tetraploid hybrids of *Nicotiana rustica* and *Nicotiana paniculata*.
Genetics 1932 : **17** : 510–44.

A full description is given of the experiments. The reciprocal cross was almost completely sterile.

The F_1 displayed 12 bivalents behaving regularly and 12 univalents passing at random to the poles without division, so that gametes with all numbers from 0 to 12 should be formed. Less than 10 per cent of viable pollen was formed.

Two of the three F_2 progenies were distinguished by high fertility and proved to have double the chromosome number of the F_1, the chromosomes uniting regularly in pairs, with occasional formation of tetravalents and univalents. These plants were extremely uniform, resembled the F_1 and rank as a species distinct from either parent.

These plants evidently resulted from the union of two diploid gametes, which are shewn to be formed with particular frequency in this hybrid. A few diploid and triploid plants also occurred amonst the same progeny. The majority of zygotes other than the tetraploids are however eliminated.

Certain aberrant types were also observed amongst the tetraploid progeny, being mostly sterile and associated with chromosome irregularities.

The tetraploid plants were interfertile but sterile with *N. paniculata*. The F_3 plants were almost identical with the F_2 and no segregation occurred.

254. Tollenaar, D. 633.71:575.243:537.531
Analyse van eenige kunstmatig verwekte mutaties in homozygote vorstenlandsche tabakslijnen. (**Analysis of various artificially produced mutations in homozygous lines of Vorstenland tobacco.**)
Versl. van de 11e Vergadering van de Vereeniging van Proefst.-Personeel 1931 : 38–48.

The Vorstenland tobaccos are the result of continued inbreeding and are absolutely pure lines. It is desired to improve them in certain isolated characters, retaining the rest of the genotype identical. The ideal way to effect this would be by monofactorial mutation.

By X-ray treatment of 2 Kanari lines 20 mutant forms were obtained, most of which on selfing gave a high proportion of Kanaris. One, however, was a *chlorina* and bred true, another a *gigas*. The remaining 18 were dominants or intermediate heterozygotes. No two mutants were alike and this indicates that the changes had occurred during meiosis.

In the F_2 monofactorial recessive mutants appeared, together with further dominant mutants, e.g. various *aurea*, one *aurea nana* with 25 leaves, one *aurea humilis* with 42 leaves and one rather more vigorous *aurea alta* with 43 leaves.

Various *aurea* mutants were also found in the X-rayed progeny of the EK lines.
The *aurea* mutants were identical with naturally occurring ones previously known and in crosses involving both these types gave similar inheritance—e.g. lethality of the factor in the pollen, with the result that no homozygotes appeared.
A *lancifolia* mutant, differing from Kanari in having a darker green leaf, an average of 3 leaves more than Kanari and earlier flowering, etc., was also studied. This again proved to be a single dominant mutant gene, apparently also lethal to the pollen. The proportions of *lancifolia* plants in the offspring varied however considerably.
One *aurea* plant also appeared in the offspring of the *latifolia* plants. It is clear, therefore, that the original treatment has resulted in an increase in mutability extending over several generations, in just such a way as has previously been observed by Lodewijks in the naturally occurring mutants. Moreover 2 cases of reverse mutation from the mutant to the normal Kanari form have now been observed.
The author is convinced by these experiments of the possibility of obtaining valuable mutant forms.

255. TOLLENAAR, D. 633.71:575.243:537.531
Kunstmatige mutaties bij tabak. (**Artificial mutations in tobacco.**)
Hand. 23e Ned. Nat.– en Geneesk. Cong. 1931 : 161–63.
A very brief outline of the work described in the foregoing paper.

256. LAMMERTS, W. E. 633.71:576.356:575.127.2
Inheritance of monosomics in *Nicotiana rustica*.
Genetics 1932 : **17** : 689–96.
In the progeny of *N. rustica* x *N. paniculata* backcrossed to *N. rustica*, 7 out of the 12 monosomics theoretically possible were obtained in plants of the *N. rustica* type ; they differed from each other in size and shape of leaves, flower size and form, etc. When crossed to *N. paniculata*, back-crossed, or selfed, the resulting progenies were generally similar as regards proportion of monosomic plants found ; in 5 types of monosomics 56—75 per cent of the functional gametes were n—1, due to lagging of chromosomes, and in the remaining 2, only about 31 per cent. The lower percentage of functional n—1 gametes in the latter did not appear to be the result of poor viability. Only 3 types of monosomics were transmitted in appreciable quantity through the pollen.
No nullosomics were found. From a consideration of other work it is concluded that there is a direct relation between degree of polyploidy and the viability of n—1 gametes and 2n—2 zygotes, and that monosomics can be recovered only in the case of polyploid species.

257. PALIBIN, I. V. 633.72
(**Tea.**)
Inst. Appl. Bot. and New Cult., Leningrad 1930 : Pp. 123.
The forests of the Anti-Tibetan highlands and neighbouring countries are now recognized as the home of the tea plant and in upper Siam and Burma many little-known races and even species are found from which tea can be made.
The present author briefly discusses the botanical characters, biology and classification of the tea family, a short account is given of the research on tea, including breeding, in progress in various countries. The subject matter is mostly quite general.

258. KARASAWA, K. 633.72:576.356.5
On triploid *Thea*.
Bot. Mag. Tokyo 1932 : **46** : 458–60.
Thea sinensis var. *macrophylla* which is characterized by gigantism and high sterility, is found to be an " autotriploid " having 15 trivalent chromosomes at metaphase in meiosis of the pollen mother cells ; these separate and move towards the poles at random. Attempts to germinate the pollen grains in artificial media failed, though some grains sprouted slightly.

259. FERWERDA, F. P. 633.73–1.531–1.541
Enten versus zaailingen bij koffie. (**Grafting versus seeds in coffee.**)
Bergcultures 1932 : **6** : 629–44.

Serious attention in Java was first paid to the grafting of coffee in 1896. It was regarded as a possible way of escape from eelworm attack then very severe on Arabica coffee. The stock used was *C. liberica*, a species which is comparatively immune. Interest in grafting waned, however, with the introduction of Robusta coffee, which is quickly raised from seed and has considerable immunity to various diseases. At the present time for one reason or other grafting is again coming to the fore and the lecture is concerned with a discussion of its merits and demerits as compared with the usual method of propagation by seed. Advantages of grafting are :—uniformity in growth and habit—less variability in yield as between individual trees. (A diagram is given to show that in a certain seedling plantation under investigation, 75% of the total yield was supplied by 47% of the total number of trees. It took, therefore, 53% of the total number of trees to supply the remaining 25%) ;—the ripening period is more defined in grafts than in seedlings, a fact which leads to economy of labour in harvesting and to control of diseases and pests attacking the berries ;—the possibility that by means of highly resistant rootstocks plantations can be laid out on infected land ;—the possibility of perpetuating a desirable variety without the mutations of seedlings—The power to transform a poor orchard into a better one by top-working the existing trees. Dealing with comparative yields it is shown by diagrams that, while seedling crops fluctuate from year to year, those of comparable grafted plantations are more regular : nevertheless, over a period of years the average yield of the grafts is considerably, i.e. 60%, lower than that of the seedlings, even when the grafts are taken from particularly good parent trees, while the compared seedlings are from unselected stock. A discussion on the reason of this phenomenon follows.

A series of experiments in pollination revealed that Robusta coffee was self sterile. It became obvious, therefore, that large plantations of grafted plants derived from a single clone would be naturally inter-sterile. This conclusion was emphasized by the fact that the boundary trees of grafted plantations, where those plantations joined others of different descent, would bear well, while the interior of the plantation would have but a poor crop. An instance is then given of plantations containing grafted plants interplanted either with seedlings or grafted plants from different clones, and these bear as well or better than a comparable seedling garden. The conclusions drawn are :—1. The laying out of large single-clone plantations is inadvisable. 2. Productive grafted plantations can be made by interplanting different clones or by leaving groups of seedlings standing in the case where an existing plantation is top grafted. 3. It cannot at present be asserted that grafted plantations will yield more than seedlings, but the advantages of uniformity in various directions coupled with the fact that the produce usually commands better prices makes the method worth while. 4. Certain hybrid varieties, which are particularly fitted for districts where the standard sorts do not flourish or which have other desirable qualities, can only be propagated by grafting.

260. *WELLENSIEK, S. J. and HAAN, J. T. DE 633.74:575(92.2)
Onderzoekingen over cacao-selectie in 1930 en 1931. (**Investigations on cacao-selection in 1930 and 1931.**)
Arch. Koffiec. Ned.-Ind. 1932 : **6** : 103–45.

This is a continuation of the work reported in " Plant Breeding Abstracts " Vol. II, Abst. 286. Yield tests were taken over a number of years for buddings and compared with their respective mother trees. The correlation between the yields of the buddings and mother trees was round about + 0·4 — 0·5, whereas similar tests with seedlings shewed a much higher correlation, over + 0·83. The mean yield of the seedlings was also higher but the coefficient of variation was distinctly lower in the clones.

With regard to susceptibility to *Helopeltis* little difference was observed and selection for resistance was not thought profitable. In respect of moth attack, however, clear differences were observed and certain clones were highly resistant. Selection for moth resistance was therefore included as one of the items in the breeding programme.

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* **A full summary of this paper is on file at the Bureau.**

Selection for quality was carried out in the way previously described (" Plant Breeding Abstracts" Vol. II, Abst. 485), by retaining only those seeds with colourless cotyledons. An examination of every seed before sowing is recommended, as out-pollination has been shewn to occur. Of the material as a whole 78 per cent was found suitable for further breeding, the rest rejected on the score of cotyledon colour. The Forastero material on the other hand contained hardly any coloured seeds and selection for quality was not necessary. There is apparently no correlation between colourless cotyledon and low yield or other undesirable characters.
The total yield estimated on a single count was regularly lower than the actual total but the correlation between the estimated and actual yields was $+ 0{\cdot}78 \pm 0{\cdot}02$; the estimated yield is therefore valid for comparative purposes. Selections based on these two ways agreed in 73·3 per cent of cases and this method should be of use in the practice of selective thinning.
Artificial pollination of 23,434 flowers increased the number of sound pods per tree from 22 to 27, i.e. about 20 per cent. No increase was observed in an experiment in which the trees were merely shaken to improve pollination.
Four high-yielding trees of both Criollo and Forastero were selected and inter-crossed with the object of combining the high yield of both forms, the fruit form and resistance of Forastero and superior quality of Criollo. Some Forastero x Criollo hybrids have been planted out on a large scale on account of their heterosis.
In making selections of the seedling trees those which had been in the best bisquintile in one or both of the 2 previous years were retained and further subjected to cotyledon examination.
Selective thinning experiments were carried out : 20·8 per cent of the lowest yielding trees from a lot of 809 mother trees were removed. An apparent increase in yield resulted but the results are not definite.
Selection was carried out on various plots of Forastero on similar lines.
Selection for earliness and other qualities is thought to be profitable.

261. WELLENSIEK, S. J. 633.74:575.12(88)
Cacao kruisingen. (**Cacao crosses.**)
Bergcultures 1932 : **6** : p. 1146.

A brief reference to hybridization work mentioned in the last annual report of the Department of Agriculture in Dutch Guiana. Amongst others, crosses were made between the finest quality Criollos and the most vigorous Forasteros.

262. WELLENSIEK, S. J. 633.74:581.162.32
Spontane kruisbestuiving bij cacao. (**Spontaneous cross-pollination in cacao.**)
Bergcultures 1932 : **6** : p. 1033.

Reference is made to a work on the subject by Harland and Freshville in Genetica 1927 ; it is pointed out that the method now in use in Java, of testing the cross-pollination by the cotyledon colour of the seeds set, is simpler since in this way a whole generation is saved.

263. APPL, J. 633.812.763.4:577.8:575.11
Die Vererbung des Geschlechts beim Gartenmajoran, *Origanum majorana* L. (**The inheritance of sex in the sweet marjoram, *Origanum majorana* L.**)
Genetica 1932 : **14** : 129–38.

Three types of plants were observed, those with only pistilate flowers, those with only staminate flowers and those with hermaphrodite flowers. For these three types the genetic formulae xx, yy, and xy respectively are suggested and serve to explain the results obtained.
The appearance of extra large hermaphrodite flowers is explained by assuming a non-disjunction of the sex chromosomes at reduction division so that one cell has both sex chromosomes and the other none.

264. SINSKAIA, E. N. 633.85
(New oil cultures.)
Lenin Acad. Agric. Sci., Inst. Plant Ind., Leningrad 1931 : Pp. 259.
A monograph on the various oil plants which are being newly introduced into the U.S.S.R. These are soya, castor, sesame, poppy, *Guisotia*, groundnut, safflower, various cucurbits, *Perilla*, tung and *Abutilon*.
For soya indications are given of the origin and distribution of the plant, followed by a botanical description of the wild and cultivated members of the genus, with indications of the high degree of variability of the characters of the latter. The characteristics of the sorts associated with different geographical regions are indicated, followed by a description of the chief sorts in cultivation and a number of general matters.
The other plants are treated on similar lines, though more briefly.

265. MOWRY, H. 633.854.56:575.22
Variation in the tung-oil tree.
Bull. Fla. Agric. Expt. Sta. 1932 : **247** : Pp. 32.
Because of the scarcity of material at first, no special attention was paid to characters of the trees from which seeds were taken and plantings at present are therefore very mixed.
Twenty-three trees from the Gainesville plantation and 9 from the Florida State Farm were studied for variation in yield, fruit size and weight, number of seeds per fruit and per pound, percentages of hull and seed in the whole fruit and percentages of kernel, oil and seed-coat in the seed.
A certain amount of variation was also noted in the flowering habit.
The greatest amount of variation was found for yield and this is probably inherited in many cases.
The tung oil tree has been successfully propagated by budding.
A description is given of the named varieties, Craig, Moore and Florida.

266. ALFARO MORENO, A. 634.31:575.252
La variación en los naranjos y la selección de injertos. **(Variation in orange trees and bud selection.)**
Agricultura, Madrid 1932 : **4** : 617–20.
Attention is called to the considerable degree of variation even in the different parts of a single tree proceeding from one single bud ; reference is made to variants such as the Washington Navel, which have entirely superseded the original and to a number of other interesting variants described in recent publications of the United States Department of Agriculture. In continuation emphasis is laid on the care which must be devoted to bud selection to avoid perpetuating one of the less desirable variant types, a few of which are described and illustrated.

267. TANAKA, T. 634.32:575.252
A monograph of the Satsuma orange, with special reference to the occurrence of new varieties through bud variation.
Mem. Fac. Sci. and Agric. Taihoku Imp. Univ. 1932 : **4** : Phytotechny, No. 1 : pp. 626.
The commercial development of the Satsuma Orange dates from about 1880 in Japan where it is known under the name of Unshû Mikan. About 1908 a similar development took place in the United States between which year and 1911 more than a million plants, it is estimated, were shipped to America. The orange which passes under this name is polymorphic and the Monograph constitutes a comprehensive study of the group with a view to improvement. It summarizes the results of over twenty years' work, much of which has appeared in previous publications, and is largely arranged in chronological sequence.
A preliminary study of references in Japanese literature carried back to 1178 leads to the conclusion that the name, Unshû Mikan, dates back only about 100 years, that its cultivation in Japan dates back at least 200 years, that it came from Huangyen through the island of Nakashima and that the Satsuma itself is the product of a chance seedling.

There follows a detailed description of the Satsuma Orange with a comparison with its closest relatives in Japan and with the closely related forms in Huangyen. This leads up to its determination as *Citrus Unshiu* Marcovitch falling within the *Nobilis* subgroup of Tanaka's Section *Acrumen*, which embraces the entire loose-skin orange group.

The development of the commercial industry in Japan has largely been brought about through the agency of professional nurseries, and the closer study of the group has involved tracing out the distribution and checking the characters of large numbers of trees in different localities. As a result a varietal classification was suggested in 1917–18 embracing six varieties (1) Ikeda, (2) Owari, (3) Zairai, (4) Hira, (5) Ikiriki and (6) Wase. In this earlier work stress is laid on the D/H (diameter/height of fruit) index ; but it was recognized that within the variety there existed strains among which one, the early maturing (Wase) Satsuma, was definitely traced to a bud variation giving rise to a single branch with early maturing fruit. The identification of strains, however, necessitated a more detailed method of determining individual characteristics. From 1919 a new method was adopted which involved stricter methods of sampling and the determination of no less than 27 fruit characters, both qualitative and quantitative. As the result of this closer study the classification of varieties was found to be in need of amendment for the Ikiriki variety proved to be identical with the Owari, while a new variety, the Maru Satsuma, closely allied to the Zairai variety was determined. Further, a form established under the commercial name of Kogakei Satsuma, from the locality in which the nurseries were established, was definitely identified as belonging to the Zairai variety.

Interest, however, centres in the Wase variety. This variety has come into commercial prominence and investigation has traced its origin to four plants, grafted on trifoliate stock, so placed in a single orchard as to suggest that they were grafted at the same time with scions carried together in the same bundle. This standard strain of the Wase Satsuma is termed the Kawano Wase from the owner of the four trees. The more important features of this variety are the somewhat dwarfed character of the tree and a fruit which is large-sized and heavily polished with thin rind having the oil cell cots widely spaced, very large pulp vesicles and a large calyx surrounded by a flat, much extended disc ring.

The central point of interest concerning the Wase variety is that, throughout Japan, there is no Wase plantation which does not contain a proportion of ordinary Satsuma individuals, a fact attributed by the ordinary grower to the variability of the Wase buds but never studied scientifically. The investigation of the author commences with a detailed study of the four original plants of the Kawano Wase which are shewn to be identical. He then pursued his investigations by studying the composition of a number of orchards in which he found Owari mixed with true Wase trees. A closer examination proved some of the trees dual, a duality which was traceable in some cases to the development of an Owari limb directly from the bud taken from a Wase tree and, in others, to a reversion of a branch on an otherwise true Wase limb.

In 1902 the investigation was further extended to cover a wider field. Prior to 1918 two cases had been identified of ordinary Satsuma trees carrying limbs bearing the Wase characters. A very detailed statistical comparison is given in both cases of the main tree and the Wase limb together with second generation plants derived thereform. These studies, involving the 27 fruit characters referred to above, led to the conclusion that in one case the Wase character arose by bud variation from an Owari plant and was handed on to the second generation trees while, in the second, though giving similar results, the variation arose from an Ikeda plant. The two Wase strains were readily differentiated and owed this difference to the duality of their origin.

These two known cases led to a still wider search with the result that a large number of instances of limb variations have been discovered scattered throughout the orchards of Japan. Over 150 pages are devoted to a detailed and critical study of these cases with a statistical study of the characters of the fruits of the Wase limb and a comparison with those of the normal part. As a result of this extensive study it is shewn that the Wase character may arise in each of the varieties of the Satsuma group. A few cases were recorded in this study of variation of a nature falling outside the Wase limits and the same critical study and comparison is made of these. The preliminary investigations and search of which details are recorded were concluded in 1926. Since then a further search has been conducted by local workers and a summary is given of a large number of further cases.

The paper concludes with an attempt to explain this tendency in the Satsuma towards vegetative variation and the almost as marked tendency of these variations to shew reversion. The presence of pollen sterility, parthenocarpy and apogamic seed formation in the Satsuma Orange make any ordinary tests by raising progeny impossible. The mutations studied bear no similarity to the thick-leaved tetraploid forms raised by Frost and cytological study by Nakamura has proved that the variation is not due to chromosomal mutation. After a discussion of the various interpretations put forward to explain vegetative mutation, he suggests wound stimulation causing plasmogenic mutation and he notes the frequent existence of queer knobs or press-markings just below the starting point of the variation or of the reverting shoot which seem to indicate that the branch had received some external stimulus.

268. MALINKIN, N. I. 634.58:575(47)
(Results of field tests and varietal investigations in groundnut in 1928-30.)
All-Russ. Sci. Inst. Cott. Ind. and Irrig., Division of Plant Breed., Tashkent 1931 : Pp. 46.

Amongst a number of general questions the results are given of comparative tests of various strains arising from mass selection and pure line selection.
Observations were made on earliness, the earliest (25 days from germination to flowering) were the small-seeded types. The medium-late group gave the highest yield, the early group the least ; the former also gave the highest oil content.
The results of the 3 years were essentially in agreement. Some of the selections of the station were earlier than the earliest American sort (Valencia).

269. SCHIPPER, W. W. 634.71:575.127
Beschrijving van inheemse intermediaire *Rubus*-bastaarden VII–VIII.
(Description of indigenous intermediate *Rubus* hybrids VII-VIII.)
Ned. Kruidk. Arch. 1931 : **3** : 510–16, 580–84.

Botanical descriptions are given of various hybrid species.

270. GRUBER, F. 634.71/5:575
Beerenobstzüchtung. **(Berry breeding.)**
Züchter 1932 : **4** : 237–42.

Various species and hybrids of *Rubus* are briefly referred to and described. Crosses between blackberry and raspberry are of interest for resistance to *Didymella applanata* but the chromosome difficulties are pointed out in connection with this cross, which gave hybrids identical with the blackberry. Large populations have been produced from these " hybrids " by selfing and backcrossing with the raspberry. Late-ripening raspberries yielding fruit in August are especially desired.
The genus *Ribes* is discussed on the same lines ; here the desiderata are red currants resistant to *Gloeosporium Ribis* and with lower acid and seed content ; black currants with long fruit clusters, simultaneous ripening of fruits and resistance to disease ; gooseberries resistant to *Sphaerotheca mors uvae*. The latter may possibly be attained by crossing with the American immune species. The first product of the cross is a very small fruited form but the F_2 contains a wealth of various forms. Large F_2 and backcross populations are produced each year and infected with the fungus, so that only the immune forms come to maturity. Selection is carried out on them. An immune form with large fruits and good flavour, has already been produced from the cross Grüne Riesenbeere x *R. pinetorum*. An entirely new type of berry, possessing an excellent aroma, has been produced from the cross *R. succirubrum* x *R. grossularia* and has been named " Jochelbeere."
With reference to *Fragaria* the superior aroma of the wild forms is emphasized. It is desired to produce types with more erect growth, canning types with little pigment, dessert types with sepals turned back and flat seeds, types giving 2 crops, large garden types with the aroma of the wild ones ; yield and disease resistance are also important considerations and only hermaphrodite forms are suitable for cultivation. Species crosses with these objects in view are in progress.

271. ROZANOVA, M. A. 634.71/5:575
(Purposes and attainments of scientific research in the field of berry growing.)
Bull. Appl. Bot. Leningrad 1932 : 8th Ser. (1) : 263–91.
The lack and need for exact study of the racial characters is emphasized. A short sketch is given of the study of the species and sorts and their classifications, followed by an outline of the methods of classification and study now in use at the Institute of Plant Industry, Leningrad. The species were usually divided into geographical sections or subspecies, these into groups, shewing parallel variation and roughly corresponding to the *varietas*. The hybrid nature of much of the material made it difficult to establish clear-cut groups but an attempt was made to place most hybrid types in one group or the other. Within the groups subdivisions were made on slighter differences, mostly of an agronomic nature. Sometimes the groups were divided into subgroups (*subvarietas*).
In this way the authoress deals with *Rubus*, *Ribes* and *Fragaria*. Schemes have been made by placing the specific characters horizontally and the characters shewing parallel variation vertically. In this way, by fitting in the various types, a clear picture is given of the specific and racial variation. The absence of particular combinations gives an indication of the linkage of certain characters.
Combined with this a full geographical and ecological study is being made to gain insight into the optimum conditions and possible limits of growth, etc., of the several sorts.
The third problem of the work is the creation of new sorts. Brief reference is made to the work of various authors in obtaining improved types by hybridization and a certain amount of more fundamental work on the inheritance of the characters, apogamy, sterility and inheritance of sex. A clear distinction is made between these studies and practical breeding.
Indications are given of various species which are regarded as having particular value for introduction or hybridization, including gooseberries resistant to *Sphaerotheca*, blackberries with fruits up to 13 mm. in length and other promising *Rubus* types, some of which, from Colombia and Ecuador, have fruit as long as 5 cm.
For the systematic production of improved forms the necessity for more exact knowledge of the mechanism of inheritance and the processes of form development, together with an exhaustive study of the species, is stressed.

272. VĪKSNE, A. 634.711:575.127.2
Ueber den experimentell erzeugten Bastard *Rubus Idaeus* L. ♀ x *R. saxatilis* L. ♂. **(On the experimentally produced hybrid *Rubus Idaeus* L. ♀ x *R. saxatilis* L. ♂)**
Acta Horti Bot. Univ. Latviensis, Riga 1931 : **6** : 84–85.
The cross *Rubus Idaeus* x *R. saxatilis* gave hybrids which resembled *R. saxatilis*, the male parent.

273. PAVLOVA, N. M. 634.72
(Currants.)
Lenin Acad. Agric. Sci., Inst. Plant Ind. and New Cult., Leningrad 1930 : Pp. 195.
A general account of the red and black currants and their cultivation. Botanical descriptions are given of *Ribes vulgare*, *R. rubrum* and *R. petraeum* under the heading red currants, with indications of their geographical distribution.
Some of the present sorts originated directly from the wild species, the majority by hybridization. The racial characters and classification are discussed in rather more detail and descriptions are given of the common sorts.
The black currants are treated on the same lines.
In a short final section on the introduction of new races, attention is drawn to the great richness of forms in Siberia, many of which may be suitable for introduction ; the ease of interspecific hybridization and the possibilities it offers for the production of new forms ; the possibilities of inter-racial hybridization for the same purpose, examples of the production of valuable forms in this way being quoted. The method of carrying out the hybridization, etc. is briefly outlined.

274. VĪKSNE, A. 634.72:575.127.2
Vorläufige Mitteilung über die Kreuzungsversuche mit *Ribes* (1924-1931). [**Preliminary communication on crosses with *Ribes*** (1924-1931).]
Acta Horti Bot. Univ. Latviensis, Riga 1931 : **6** : 86–89.

Forty-four crosses were made with 22 different forms, of these only 8 gave well-developed hybrids, the rest either set no fruit or the seeds failed to germinate.

The following crosses were successful : *R. nigrum* x *R. aureum*, *R. Grossularia* x *R. utile*, *R. utile* x *R. niveum*, *R. rotundifolium* x *R. niveum*, *R.* " *rubrum* " hort. = *R. pallidum* Otto et Dietr. x *R. nigrum* and the reciprocal, and *R. nigrum* x *R. Grossularia*.

275. ZIEGLER, A. and MORIO. 634.835(43.35)
Die Rebenzüchtung in Bayern 1927–1930. (**Grape breeding in Bavaria.**)
Landw. Jb. Bayern 1931 : **21** : 417–83.

A general account of the methods of research. A negative correlation was observed between yield and must production.

Selfing of European sorts led to reduced vigour ; reciprocal crosses often gave very different results.

276. 634.836.75.091
HUSFELD, B. 634.835:575.11
Ueber die Züchtung plasmoparawiderstandsfähiger Reben. (**Breeding grape vines resistant to *Plasmopara*.**)
Gartenbauwiss. 1932 : **7** : 15–92.

The methods of artificial infection, which make breeding possible, are described, together with certain other general matters, including the methods of producing the hybrids and raising them.

Large numbers of hybrids between American and European vines have been made but to gain time F_2 generations have been produced by selfing well-known commercial hybrids.

No defects were observed as a result of inbreeding. The various dwarfs and other anomalous forms appearing were the result of ordinary segregation. A marked heterosis was observed in the F_1's of American x European vines and their reciprocals.

Economy in work, etc., was effected by retaining only those plants which proved to be resistant in the F_2.

Special observations on selfed or hybrid families have shewn that the hermaphrodite American vines segregate on self or free pollination and thus are highly heterozygous.

Over half a million seeds of the hybrid Mourvèdre x Rupestris 1202C were sown in 1930 and again in 1931 and over a million in 1932, and this F_2 was subjected to selection for resistance by artificial infection. A further 10,000 were not infected and served for the study of other characters. Of these 2,935 plants were examined for the leaf colour in autumn, which gave a ratio of 1 : 2 : 1 red, light-red and yellow. A more accurate examination of a further 913 plants confirmed this ratio. There was in every case, however, a slight deficiency of yellows, which are evidently less viable.

The plants with upright shoot tips were in the majority, 654 against 155 semi-pendulous and 40 pendulous, from which it is concluded that two factors are present, giving a 9 : 3 : 3 : 1 ratio. A similar conclusion is reached in respect of branching, 700 unbranched or slightly branched, 197 branched and 68 bushy plants being observed.

For the remaining characters investigated no clear ratios could be established, multiple factors being evidently operative ; these characters were : vine nodes, type of growth, sinus of the leaf pedicel, lobe and tooth formation in the leaf, form of leaf and sinus. The sinus in particular gave very pronounced transgressive segregation. The leaf form was independent of the sinus form and also shewed a wide range of variation. All the above characters in fact combined independently, giving an almost endless range of combinations of the parental types. Certain of the new types are illustrated. Almost all combinations of characters were also observed in the dwarf forms which appeared.

The *Plasmopara* observations shewed that no absolutely immune form exists in *Euvitis*. After 8-times repeated infection of the above F_2 seedlings in 1930 only 31 plants remained in the class

designated " resistant." In 1931, 21 resistant plants remained. Hence only about 50 resistant plants appeared amongst the million tested. These moreover were not of the European type. These figures seem to indicate that resistance depends upon a very large number of factors and certainly the hybrid in question cannot be regarded as a suitable source of resistant forms.
A large-scale F_2 was produced on similar lines from seeds of the hybrid Gamay x Riparia 595 Oberlin. In this case many more resistants than in the previous material were detected. In one lot of 500,000 as many as 25 per cent were resistant and after a further 7 infections 26,000 resistant plants remained. Furthermore, many plants of the European type appeared. Segregation for the other characters was however as varied as in the previous case, so that amongst tens of thousands of F_2 plants hardly two were alike. Observations of the resistant segregates indicated that both European and American types occurred amongst them and no correlation exists between resistance and the American habit.
Chromosome counts of root tips of both the above hybrids shewed a diploid number of 38, which number was also characteristic of all the segregates examined. . Certain plants arising from selfing of a plant of Moselriesling, however, had an unmistakable diploid complement of 40. These plants are going to be crossed with members of the subgenus *Muscadinia*, e.g. *Vitis rotundifolia*, which also have 40 chromosomes, in the hope of obtaining fertile hybrids, *V. rotundifolia* being a desirable parent in that it is completely immune to phylloxera and *Plasmopara*.
The results of studies on the infection by the parasite are presented. Here again it is clear that varying degrees of resistance exist. From these observations it was also clear that in the segregating population resistance was independent of peculiarities of leaf morphology.
Almost all the American x European hybrids available were selfed and a list is given of those which gave resistant plants in their offspring. The list is considerable and contains many of the old " direct producers." The author expresses confidence that amongst the resistant segregates a considerable proportion will be found which combine the other necessary qualities of a good wine grape. As these latter evidently depend upon a large number of factors, the essential condition for success is the use of very large families.

277. FISCHER, G. 634.94:575
Gedanken zum Ausbau der Forstpflanzenzüchtung. (**Considerations on the extension of forest plant breeding.**)
Silva 1931 : **44** : 348–51.

Following upon other perennial plants, forest trees are, in Germany, now coming into the field of plant breeding and are of great moment, since the timber industry is in a serious position. The author points out that improvements in cultural practice, etc., can never bring their full return until the actual races most capable of making use of these are produced. The production of immune races is the only economical way of combating disease.
Various disadvantages and advantages of forest breeding as compared with ordinary breeding are mentioned. A centralized system of breeding is recommended, the actual work being carried out at the place for which each type is designed, i e. such a system as the combined system of forestry and breeding institutes which has been started with this end in Germany. The necessity for state-controlled rather than private breeding is stressed.

278. FABRICIUS, L. 634.94:575.42
Forstliche Versuche. XI. Pflanzenauslese im Saatbeet. (**Forestry experiments. XI. Plant selection in the seed bed.**)
Forstwiss. Zbl. 1931 : **53** : 449–57.

From a lot of several thousand pine seedlings 2,000 of the worst and 2,000 of the best seedlings were selected and grown together.
The better individuals of the poorer class as a result of the transplanting rapidly caught up and many of them even excelled some of the other class after three years, the poorest individuals of the poorer class, however, were left behind more and more, clearly shewing that their inferiority was inherent.
It is argued, therefore, that selection is profitable only in so far as it consists in removing the very worst and clearly inferior seedlings.
Experiments with other trees shews that the position is not the same for all trees and the question of selection in the seedling stage requires further study.

279. HAYASI, S. 635.41:577.881
(Relation between age of the seed and sex in spinach.)
Agric. and Hort. Japan 1932 : **7** ; 1449–56.
Older seeds germinated less well, especially the males, with the result that female plants preponderated in cultures from old plants.

280. SINNOTT, E. W. 635.62:575.11.061.1:581.47
Shape changes during fruit development in *Cucurbita* and their importance in the study of shape inheritance.
Amer. Nat. 1932 : **66** : 301–09.
The major shape differences visible in the mature fruit are evident in the very early stages of the flower but as development proceeds certain minor but definite changes occur, leading to a slight progressive increase in degree of flattening of shape. Fruits stop growth and become mature at widely different sizes if environmental conditions vary or if there is a segregation for size factors, and the mature fruit retains the shape index characteristic of the developmental stage attained when growth ceased. Thus in studying the inheritance of shape the complicating presence of size differences must be considered.
Studying small ovary primordia instead of large mature fruit has the advantage that size differences which become apparent later in the life-history are avoided and larger numbers of observations are possible. Data are provided which shew that a more clear-cut segregation for shape is obtained when small primordia are used.

281. GABAEV, S. G. 635.63
(Cucumbers.)
Lenin Acad. Agric. Sci., Division Plant Ind., Leningrad 1932 : Pp. 212.
The extreme antiquity of the crop is indicated by reference to the literature. The botanical characters of the plant are described. The distinguishing racial characters are discussed with reference to their degree of variability. Some of the qualitative characters of the fruit appear to be constant and of consequent diagnostic value. As the classification of the species is at present very imperfect, the question was studied afresh on the basis of the world collection made by the author. Fourteen varieties were established and are described and illustrated. The chief commercial sorts of the U.S.S.R., Europe and America are also described.
Breeding has been in progress only a comparatively short time. Various features are mentioned which make the cucumber a specially suitable object of breeding. An outline is given of the methods of carrying out mass selection and individual selection by inbreeding. No difficulty was experienced in self-pollinating, 57·5 per cent success being attained, compared with 65·2 per cent on crossing. The plants obtained from self-pollination were also as vigorous as those from cross-pollination. No difference in the number of seeds produced per fruit was observed between free, artificially cross and self-pollinated fruits.
Repeated selfing in order to obtain homozygous lines is recommended before undertaking hybridization between two types whose qualities it is desired to combine. The characteristics desired in cucumbers of the different types are enumerated.

282. 635.64 Pritchard
PORTE, W. S. 635.64–2.484–1.521.6:575
The Pritchard tomato.
Circ. U.S. Dept. Agric. 1932 : **243** ; Pp. 4.
A description of this variety, the result of a cross between Marglobe and Cooper Special, which is very resistant to wilt and to the nailhead rust of the fruit.

283. LESLEY, J. W. 635.64:575.116.4:576.356
Trisomic types of the tomato and their relation to the genes.
Genetics 1932 : **17** : 545–59.
Two new trisomics in which the extra chromosome is known are described and illustrated. In trisomics involving certain chromosomes (e.g. the B and the D chromosomes) the extra chromo-

somes are transmitted to a certain extent in the pollen and selfing these gave rise to tetrasomics; these, although less so than the trisomics, were partially fruitful and possessed the characteristics of the corresponding trisomics in an accentuated form.
By pollinating diploid dd plants by a plant trisomic for the A chromosome and apparently of the constitution Ddd in respect of the d (dwarf) gene located in this chromosome, only diploid progeny was obtained. The proportion of dwarf plants was reduced from the expected 2 : 1 almost to 1 : 1 and it is supposed that an A chromosome or part of it containing d had been lost.
The gene pair Rr for fruit colour gave clear trisomic inheritance in selfed progenies of the I trisomic and is therefore almost certainly in this chromosome. Similarly the Ll gene pair is ascribed to the B chromosome.
Trisomics shewed the gene R to be incompletely dominant to rr, although it is completely dominant to r in normal diploids.
Extra chromosomes carrying the major genes for certain characters had less effect on the character in question than the presence of other chromosomes not carrying such genes. The D chromosome, for example, although not carrying genes for fruit size or pyriform shape, has considerable influence on both these characters.

284. MOMOT, JA. G. 635.655
(Testing soya beans in the U.S.S.R.)
Lenin Acad. Agric. Sci., Inst. Plant Ind., Division of Crop Tests 1932 : Pp. 108.
A classification of the various sorts is given, followed by descriptions of the individual sorts. Large numbers of these have been imported from the east and this constitutes a valuable basis on which selection is being practised. The problems and lines of selection of soya for various purposes are outlined.

285. WELLENSIEK, S. J. 635.656:575.11
De ontwikkeling onzer genetiese kennis van *Pisum*. (**The development of our genetical knowledge about *Pisum*.**)
Hand. 6th Ned.-Ind. Nat.-wetensch, Cong. Java 1931 : 321–27.
Emphasis is laid on the fact that not only may several distinct genotypic constitutions result in the same phenotype but one gene may influence several distinct characters. Further, that one character—waxiness for instance—may be influenced by various series of multiple allelomorphs, successively increasing the effect of this basal gene B1. The second series W_2b and W_1b act only in the presence of W_2a. On the other hand W_1a is uninfluenced. This suggests a stereochemical difference between W_2a and W_1a and the whole system is very like an enzyme system.
Comments are made on the existence in *Pisum* of more than 50 per cent crossing over, of double crossing over and interference and the existence of 2 linkage groups more than the number of chromosomes.

286. HAAN, H. DE 635.656:575.11:581.446.1
The heredity of emergences in *Pisum sativum*. (Preliminary communication.)
Genetica 1932 : **14** : 319–20.
Highly sterile, aberrant plants found in the F_2 of a cross between two forms of peas were characterized by tendril like emergences on the stems. Two factor pairs are apparently concerned and these plants are the double recessives.

287. HAAN, H. DE 635.656:575.11 –181.13
Erffactoren voor de stengellengte van de erwt. (**Hereditary factors for the stem length of the pea.**)
Jaarb. Oudleerlingen Middelbaar Landbouwonderwijs 1931 : 87–93.
A popular explanation of Mendel's crosses of short and tall peas, after which it is shewn that stem length actually depends on several factors, of which 5 have so far been determined.

288. Haan, H. de 635.656:575.113:576.16
Erffactoren en verwantschap. (**Hereditary factors and relationship.**)
Jaarb. Oudleerlingen Middelbaar Landbouwonderwijs 1932 : 125–35.
A simple explanation of Mendel's discoveries, multiple factors for colour in the flowers of *Pisum*, the origin of new forms by mutation of one or other of these factors, the dependence of quantitative characters such as length on similar multiple factors. The case of 2 complementary length-inhibiting factors, which when both recessive give a " bolter " is illustrated by the author's own material ; the composition with regard to these factors of a number of common sorts is given in the form of a genealogical table, which shews that many forms possessing the recessive of one of these factors are interrelated and the recessives can probably all be traced back to a recessive mutation at a quite distant date.
Other cases are referred to where relationship between two sorts has been indicated by the appearance in crosses between them of unusual recessive forms, for which each proved to be heterozygous.

289. Stoletova, E. A. 635.75
(**Coriander.**)
Lenin Acad. Agric. Sci., Inst. Plant Ind. Leningrad 1931 : Pp. 68.
The authoress gives, amongst a number of more general questions, a botanical description of the plant, together with an indication of the degree of variability of the characters, and a key for the determination of the sorts, the chief of which are described.

BOOK REVIEWS.

Plate, L. 575.1
Vererbungslehre. (**Genetics.**)
Gustav Fischer, Jena, 1932 : RM 26. Pp. X + 554. 133 illus.
The first edition of this work has long been out of print and in this, the second edition, the subject matter has been entirely revised and amplified, in the attempt to present the modern viewpoint of genetics, especially in its more theoretical aspects.
The first volume under the title " Mendelism," is an exposition of the classical sections of genetical theory. Great emphasis is laid on the all-importance of heredity in determining even the minutest details of character of the plant and animal.
The whole volume is devoted to a rather exhaustive treatment of various general topics, including statistics, selection and other allied questions, followed by the various phenomena of inheritance, the more fundamental questions of the nature of the phenomena and of the gene, and the chromosome mechanism of inheritance.
The book is a tribute to the way in which the older school of geneticists is endeavouring to keep pace with modern advances. It makes no claim to be exhaustive, yet in view of some of the material which has been included it is difficult to account for the absence of reference to certain subjects, e.g. in the discussion of crossing over and meiosis, the detailed observations which have claimed so much attention from modern cytogeneticists. It is also difficult, in the light of recent advances in the genetics of interspecific and intergeneric crosses, to see the justification for the sharp distinction which the author makes between specific and higher group differences with regard to their nature and origin.
The book is well illustrated and each section is furnished with a selected bibliography.

575.1
HURST, C. C. 576.12
The mechanism of creative evolution.
Cambridge University Press, London, 1932: 21*s*. Pp. xxi + 365. 199 illus.

The physical basis of creative evolution has, the author claims in the preface, been experimentally established. "Man, if he chooses, can, here and now, take a hand in creative evolution by creating new species of living organisms and replacing natural selection by human selection."
This, breeders will say, appears to be the milennium. The book is devoted to an explanation of the new knowledge and how it may lead to the milennium or the complete reverse, depending entirely on the intelligent application of the knowledge in the near and distant future. The book is therefore not only a work on evolution but a full and eminently readable treatise on the laws of inheritance.
The classic experiments of Mendel are described in detail, with the interesting addition of the author's own results in repeating the experiments. The whole history of the science of cytogenetics is presented in such a way as to evoke the spirit of adventure in which it must have been pursued by those, like the author, who have followed it from its birth.
The existence of the species as a genetic and cytological unit is demonstrated. After this several chapters are devoted to cytological phenomena connected with inheritance, including the author's own results on polyploid species of *Rosa*, which, accompanied by abundant material from other authors; afford an excellent basis for illustrating the origin of new species by the combination of genoms from existing ones, and the behaviour of these genoms in inheritance. Much emphasis is laid on the important part played by chromosome doubling in enabling otherwise sterile hybrids, with incompatible chromosome sets, to produce fertile plants, which in nearly every case constitute new species. The frequency at the present day of plants with duplicated chromosomes or chromosome sets shews the role selection has played in preserving these aberrant types.
Results on experimentally produced mutations and transmutations indicate that each genus has a particular type of instability; the correspondence of these with the naturally occurring mutants and the differences between existing species indicates the major part that such changes have played in evolution.
Recent results of Philiptchenko and the author have shewn that many desirable characters are influenced by systems of basic and modifying factors and the significance of this for problems of breeding and racial improvement is made clear.
Considering less and less highly organized chromosome apparatuses on passing from the higher animals and plants to the lowest known organisms like the bacteriophages, in which the genes are not united into chromosomes but apparently lie free, the author comes to regard the protogene as the primary unit of life.
In a similar way the genetical species, sometimes consisting of several Linnean species, is regarded as the unit of evolution, giving rise in the course of time to the higher groups such as genera, families, etc. The work ends with a speculative section dealing with the mode of evolution and its possible trend in the future.
The volume is superbly illustrated.

575.1
SANSOME, F. W. and PHILP, J. 576.3
Recent advances in plant genetics.
J. and A. Churchill, London, 1932: 15*s*. Pp. x + 414. 98 illus.

The volume under review is a summary of the most recent developments and views on the phenomena of inheritance in the plant kingdom. As such it makes no claim to present the more familiar and elementary laws of Mendelian inheritance in the classic sense. This in a textbook of genetics is refreshing.
The role of the chromosomes in inheritance is the theme of the opening remarks and this gives the key to the whole work, which might almost equally be called a textbook of cytology; in fact the two sciences have become so interwoven that it seems preferable to refer to them jointly as the science of cytogenetics.

Darlington's views on chromosome behaviour are adopted as they, in the opinion of the authors, fit the facts in the simplest and most satisfactory way. As the subject is of importance for a true understanding of the mechanism of inheritance it is argued at some length and evidence of a very cogent nature is presented in support of it, mainly in connection with the partial chiasmatype theory of crossing over.

An impressive body of evidence shews how the behaviour of the factors can be correlated with the behaviour not only of particular chromosomes but of particular parts of the chromosome. Just as the atom ceased to be the ultimate indivisible unit of matter, so the gene was apparently doomed to cede the title of unit of hereditary material and we are assured in the third chapter that the gene is composed of numerous " elements " which moreover occupy different portions of the locus. It is evident that modern theories of the gene are becoming more and more quantitative in nature.

The recent chromosome studies have been attended by signal success in elucidating genetical problems which have baffled geneticists for some time. The very cases which at one time constituted serious exceptions to the laws have now served to consolidate them and anticipate new ones. Perfectly good taxonomic species have been created artificially and the question of the nature and origin of species, although not by any means solved, has assumed a very different and more clearly defined aspect as a result of the new knowledge.

The material is highly specialized and is not easy to present in readable sequence. In several places the account of results of other workers is given in such a way as not to be clear to the reader without reference to the original. There are various surprising omissions, especially of reference to important Russian work—for instance Philiptchenko's views receive no mention in the discussion of " shift " nor do the recent cytological works of Levitsky. Imperfections are inevitable in a work of this nature however, and no serious student of biology can afford to overlook this unique presentation of the results of the last few years in the field of cytogenetics as it relates to the plant kingdom.

FORD, E. B. 575.1:576.12

Mendelism and evolution.

Methuen and Co., Ltd., London, 1931 : 3*s*. 6*d*. Pp. xii + 116. 6 illus.

In a small book of one hundred pages it is not possible to give more than the merest outline of two such wide subjects. The Mendelian laws are clearly explained in a short chapter. Considerable stress is laid on the interaction of the gene and the environment in the expression of a character, a whole chapter being devoted to this theme; it is shewn that the environmental effect may be exercised by external conditions or by the other genes in the organism. This enables the author to lead on to the theory of the evolution of dominance, which is summarized in a clear and concise form. The salient results of these considerations is the recognition that in addition to natural selection of advantageous characters " the effects of a gene, if advantageous, may be intensified, and perhaps altered in quality, owing to the tendency for those individuals to be preserved whose gene-complex brings them out to the greatest extent." In this way the idea of a slow, adaptive evolution can be reconciled with the unit factor inheritance of many of the factors concerned and the origin of the genes by spontaneous mutation.

In the final chapter the relation of these facts to the origin of species from isolated groups is considered, together with the origin of sex differences.

POPOFF, M. 575.76:578.088

Die Zellstimulation. Ihre Anwendung in der Pflanzenzüchtung und Medizin.

(**Cell stimulation. Its application in plant breeding and medicine.**)

Paul Parey, Berlin 1931 : RM. 23. 40 : Pp. VIII + 375. 45 illus.

A depressed vitality of the cells combined with reduced activity of the oxidation processes is responsible for the setting in of the reproductive stage. A variety of agencies, one of the commonest but by no means the only one being fertilization, are capable of restoring this reduced activity. The phenomenon as familiar in the case of the egg cell is only an example of the more general phenomenon of cell stimulation as applied to any cell. The agents whereby

the normal oxidation and other processes are restored, produce a hypernormal activity for a certain time, thus acting as stimulants. This may with some reagents go too far and cause poisoning. Each stimulant has a particular concentration at which it produces the optimum effect. The water-absorbing power of the cell colloids is at the same time increased, the optimum concentration for these two effects being approximately the same.

This in short is the author's theory and the main bulk of the volume is taken up with an account of experiments in support of it, followed by those in which the stimulation can be put to practical use. A great variety of chemical and physical reagents are shewn to be capable, in suitable doses, of producing the effects, many of these being familiar pharmaceutical reagents such as phenols, narcotics and the like.

The principle has been applied amongst other things to stimulating the germinating capacity of seeds, the rice plant being used to illustrate this, on account of the extreme sensitivity of its seeds. The optimum time for various other plants in a number of different solutions is given. Field tests on the plants from treated seeds shewed that they had developed more vigorously and exceeded the controls both in size and number of cells. By repeating the stimulation on growing the second generation an enhanced effect was produced and even without a repeated stimulation the effect of the first one was detectable in the second generation.

Dry application of the stimulants in suitable doses was found to produce similar effects and a like result was obtained in experiments with ultra-violet irradiation, high frequency radiation, radium emanation, high potential electric currents, X-rays and also various hormones when applied in suitable doses.

In every case an optimum " dose " occurs, and doses above this cause a reduction or reversal of the stimulating effect. It is characteristic of the reactions, however, that not one but several maxima occur at different concentrations. In between these are minima, so that the precise concentration at which the materials are administered is of great importance.

This, and the identical effect produced by such varied agents, indicates that the reaction is a fundamental property connected with the colloidal nature of the protoplasm.

The possibility is suggested of subjecting repeated generations to stimulation and selecting those which give the greatest response—i.e. have greatest capacity for making use of the stimulation process. It is thought that in this way it would be possible to breed strains with higher yielding ability.

CAULLERY, M. 576.12
Le problème de l'evolution. **(The problem of evolution.)**
Payot, Paris, 1931 : 40 fr. Pp. 448. 88 illus.

MORGAN, T. H.
The scientific basis of evolution.
Faber and Faber, Ltd., London, 1932 : 15*s.* Pp. ix + 286. 42 illus.

HALDANE, J. B. S.
The causes of evolution.
Longmans, Green and Co., London, New York, Toronto, 1932 : 7*s.* 6*d.* Pp. vii + 235. 16 illus.

The first of these three volumes represents a course of lectures on the evolution of plants and animals and aims at being no more than a general survey. The first part is concerned with the proofs of evolution and in the second the main theories of evolution are set out as clearly as possible and without partiality. In the second Professor Morgan subjects the multifarious data and hypotheses relating to the theory of evolution to a piercing scientific and dispassionate examination, whilst the third, after a critical discussion of the mechanism of evolution, goes on to a somewhat more general treatment of some of its problems, with rather particular reference to the action of natural selection.

From a consideration of these works emerges the realization that a new epoch has arrived in the theory of the origin of plants and animals, largely brought about by the study of experimental genetics and the origin of new varieties, species and even genera under cultivation.
The existence of evolution is no longer seriously questioned and many points of agreement have been reached as to its mechanism. The random variations postulated by Darwin have been more clearly defined as point mutations occurring at random. These supply the material for selection, which cannot create but only remove those which are less " fit," in the widest sense, that is, of this term. Mutations also supply the material for re-combination, which can be brought about in a variety of ways ; six such ways dependent upon chromosome behaviour are mentioned by Haldane, perhaps the most outstanding being the ordinary mechanism of Mendelian segregation and recombination, as exemplified by meiosis, various types of chromosome aberrations, and irregularities of chromosome behaviour leading to polyploidy. New types resulting from such recombination become fixed owing to sterility, resulting either from their mode of origin, as with polyploids, or later by gradual differentiation resulting from mutation. Differences between species and between genera are thus the same in nature as those between varieties and races, being distinguished only in degree.
The evolution of the past is written in the rocks ; the evolution of the future lies mainly in the hands of the breeders. In the past, evolution has been an inexorable and uncontrollable force. It is gradually becoming susceptible of experimental control and that is why a knowledge of its mechanism is of primary importance to the breeder, in whose hands is the power to accelerate or retard its progress.

Lowig, E. 581.162.5:575.127
Die Sterilitätserscheinungen bei den höheren Pflanzen und ihre Bedeutung für den gärtnerischen Pflanzenbau und die Pflanzenzucht. (**Sterility phenomena in the higher plants and its importance in horticulture and plant breeding.**)
Höstermann und Wehrhahns Wiss. und Technik d. Gartenbaues. J. Neumann, Neudamm, 1931 : RM. 3.50 : Pp. 84. 27 illus.
Sterility is defined as the incapacity of the plant to form normal gametes or seeds capable of development.
Three types are distinguished : cross-sterility, when no viable seed is set as the result of pollination between two different individuals, the sterility of the individual flower, and self-sterility, when no viable seed is set when the plant is pollinated with its own pollen or from another plant derived from the same stock by vegetative propagation.
The sterility of the individual is first dealt with, including the forms of pseudo-sterility, herkogamy in which self-fertilization is impossible because of the arrangement of the reproductive organs and dichogamy when the male and female organs mature at different times. The lack of the appropriate insect may also cause sterility when the plant is grown in another country. True sterility is due to the malformation of male or female or both reproductive organs. This may be either constitutional or induced by external conditions. There are also cases of pseudo-sterility in self-sterile plants. The various forms and causes of self-sterility are described and lists of the self-sterile fruit varieties are given.
Self-sterility occurs in almost all species but probably no species is only self-sterile. Under certain conditions pseudo-self-fertility may occur in normally self-sterile plants.
Cases of parthenogenesis and apogamy are dealt with under cross-sterility and the different forms and causes of cross-sterility are described and lists and diagrams are given of the inter-sterile and inter-fertile groups of pears and cherries. There is a list of 161 references.

Volkart, A. 633.1:575
Kurzgefasste Anleitung zur Getreidezucht. (**A short guide to cereal breeding.**)
Verbandsdruckerei A. G. Bern 1931 : 1 fr. Pp. 63. 11 illus.
A general account of the methods for breeding wheat, oats, barley and rye with special regard to the practical requirements of Switzerland.

HALL, C. J. J. VAN 633.74
Cacao.
Macmillan and Co., Ltd., London, 1932: 28*s.* net. Pp. xviii + 514. 175 illus.

It is now 17 years since the first edition of this manual was published and all those interested in the crop from a general or special point of view will welcome the appearance of the second edition, which has been largely revised and brought up to date and rechristened "Cacao" in place of "Cocoa." The book is profusely and excellently illustrated.

After a general historical introduction the origin and geographical distribution is discussed; the basin of the Amazon is regarded as the home of the Forastero, Central America of the Criollo variety.

The fourth chapter is devoted to the botany of *Theobroma*, including a key for the determination of the species, only two of which are cultivated. In discussing the floral biology the author expresses the opinion that wind pollination is by no means exceptional; also that the normal amount of pollination, although small, is sufficient for the tree's requirements. Short descriptions of the non-cultivated species are also furnished.

The varieties of cacao afford the subject of a separate chapter. A new chapter on selection has been introduced, in which a brief outline is given of the methods of "mother-tree selection" in which the services of the overseers of estates are enlisted, together with a number of general observations on the practice of selection. The results of selection in Java and Trinidad are quoted.

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INDEX.

Achyutha Wariar, U., 149
Akhtar, A. R., 154
Alfaro Moreno, A., 266
Anderson, E. G., 210
Anonymous, 152, 166, 180, 225, 235
Appl, J., 263
Artemov, P. K., 186
Asana, J. J., 160
Ashby, E., 148
Avtonomov, A. I., 243

Banerji, I., 159
Bauch, R., 181, 182
Beadle, G. W., 213, 214
Berg, K. H. v., 198
Bescoby, H. B., 137
Beztuzheva, A. A., 183
Bledsoe, R. P., 189
Boeuf, F., 193
Bonvicini, M., 220
Breslavetz, L., 248
Bressman, E. N., 197
Briggs, F. N., 202
Brink, R. A., 217
Brown, C. H., 158
Burnham, C. R., 247

C . . . . ., R. C., 167
Caullery, M., p. 82
Cheesman, E. E., 161
Chizaki, Y., 199
Chmelař, F., 230
Churchward, J. G., 143
Collings, G. H., 245
Collins, G. N., 216
Cooper, D. C., 217
Cotter, R. U., 206, 208
Crane, M. B., 163
Crim, R. F., 212
Crowther, F., 138

Dalley, C. L., 194
Darlington, C. D., 135
Davis, R. L., 250
Dekaprelevich, L. A., 190

Elliott, J. W., 196
Eloff, G., 171
Emerson, R. A., 210, 213
Eritzian, A., 200

Fabricius, L., 278
Ferwerda, F. P., 259
Fischer, G., 277
Ford, E. B., p. 81
Forster, H. C., 136

Gabaev, S. G., 281
Ganguli, P. M., 153
Gavaudan, P., 241
Gescher, N. v. 176, 185
Gregory, F. G., 138
Gruber, F., 175, 270
Guscin, G. G., 224

Haan, H. de, 286-288
Haan, J. T. de, 260
Haldane, J. B. S., 132, p. 82
Hall, C. J. J. van, p. 84
Hall, D., 162
Harland, S. C., 155, 156, 240
Hayasi, S., 279
Hayes, H. K., 212
Hogben, L., 132, 133
Holbert, J. R., 219
Hoover, M. M., 205
Hurst, C. C., p. 80
Husfeld, B., 276
Huskins, C. L., 147
Hüttig, W., 188

Immer, F. R., 179

Jakubziner, M., 191
Jarrett, P. H., 142
Johnson, I. J., 212
Jones, E. T., 147

Kalamkar, R. J., 139
Karasawa, K., 258
Karper, R. E., 223
Katayama, Y., 201
Kemp, W. B., 209
Kidder, A. F., 246
Kihara, H., 201, 204
Kondo, M., 227
Konstantinov, N., 244
Kottur, G. L., 141, 157
Krishna Rao, P., 149
Kristensen, R. K., 178
Kulkarni, R. K., 151

Lambert, A. R., 138
Lammerts, W. E., 256
Legáspi, T. T., 249
Lesley, J. W., 283
Levine, M. N., 208
Lowig, E., p. 83

MacArthur, J. W., 170
McCray, F. A., 251, 252
Macindoe, S. L., 145
Malinkin, N. I., 268
Mangelsdorf, P. C., 211
Menabde, V. L., 190
Mitra, S. K., 153
Moffett, A. A., 165
Momot, Ja. G., 284
Morgan, T. H., 169, p. 82
Morio, 275
Mowry, H., 265

Nelson, L. W., 195
Nishiyama, I., 204

Opitz, K., 187

Palibin, I. V., 257
Pavlova, N. M., 273
Pesola, V. A., 207

Petri, L., 238
Petropavlovsky, M. T., 203
Philp, J., p. 80
Pirovano, A., 172
Plate, L., p. 79
Pope, M. N., 215
Popoff, M., p. 81
Porte, W. S., 282
Pruzkova, M. G., 186

Rangaswami Ayyangar, G. N., 149, 150
Rathlef, H. v., 234
Reinhardt, F., 177
Richey, F. D., 218
Robb, W., 146
Rodenhiser, H. A., 222
Roodenburg, J. W. M., 168
Rozanova, M. A., 271

Salaman, R. N., 237
Sampietro, G., 229
Sankara Ayyar, M. A., 150
Sansome, F. W., p. 80
Sarakhov, I. P., 239
Schick, R., 184, 236
Schipper, W. W., 269
Scott, R. A., 140
Selim, Abd el Ghaffar, 158
Shirakawa, M., 228
Simon, J., 230, 231
Singleton, W. R., 253
Sinnott, E. W., 280
Sinskaia, E. N., 173, 183, 264
Snyder, M. H., 205
Soljakov, P. A., 186
Spinks, G. T., 164
Sprague, G. F., 215, 218
Stevenson, F. J., 232
Stewart, G., 194, 195
Stoletova, E. A., 289
Sutaria, R. N., 160
Szymanek, J., 241, 242

Tabata, K., 228
Tanaka, T., 267
Terazawa, Y., 226
Tolaas, A. G., 233
Tollenaar, D., 254, 255
Troitzky, N. A., 192
Tschermak-Seysenegg, E., 221

Vasey, A. J., 136
Vavilov, N. I., 134
Viksne, A., 272, 274
Volkart, A., p. 83

Wallace, R. W., 245
Waterhouse, W. L., 144
Wellensiek, S. J., 260-262, 285
Wenholz, H., 145
Wogata, K., 228

Yasuda, S., 174
Youssef, A., 158

Ziegler, A., 275